



**Community-Based Adaptation to Climate Change: Case study of three  
Communities in Mozambique covered by PACA Project**

by

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## **Biographical Note**

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“We operate in a world which is searching for a better life-without the imprisonment of dogma.”

Nelson Mandela (1997)

## **Abstract**

This study mainly aims at evaluating the PACA (Community Action Plans for Adaptation) project, which is a Community-Based Adaptation (CBA) project designed by the Mozambican Government. One of the main problems that PACA project sought to solve was water shortage, mainly due to the drought that devastated most of the country from 2015 to 2017. Besides doing an overall evaluation of the project, this study is more focused on doing the evaluation through understanding how the local groups are organized and how they manage the common scarce resource that they share, which is water. Besides the adaptation measures implemented by PACA project, it is crucial to analyze the management system of the infrastructure because that is what will sustain the project. We argue that without a good management system, the project cannot sustain itself. The model used to evaluate the water infrastructure management system was the "Design Principles" by Elinor Ostrom, and some other literature sources on Community-based projects were used to give an overall evaluation of the PACA project.

The results of the study show that the CBA projects are vital in the process of adaptation to climate change in Mozambique, though each case is different depending on the context of each community. It was found that the PACA project was following the CBA projects key features, and the management systems are satisfactory, according to Ostrom's "Design Principles." This study shows that some initial objectives were still not met, because the project ended recently. It also argues that such projects have to be better planned so that the project could be capable of generating sustainable long-term improvements in livelihoods and well-being for the community members. Time constraints were considered the main problem of the PACA project.

Many CBA practitioners are established in nongovernment organizations, and government agencies, where they face time constraints to publish in academic journals. That means that much of their knowledge and experience is not shared as widely as it should be. For this reason, the present study brings up the experience of a CBA project in three rural communities in the south of Mozambique. Moreover, this research can be useful to the Mozambican Government and for the organizations that took part in the PACA process.

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Keywords: Mozambique, Climate Change, Adaptation to Climate Change, Community-Based Adaptation projects

## **Resumo**

O principal objectivo deste estudo é fazer uma avaliação do projecto PACA (Planos de Acção Comunitária de Adaptação), que é um projecto de Adaptação Baseada na Comunidade (CBA) desenhado pelo governo moçambicano. Um dos principais problemas que o projecto PACA procurou resolver foi relacionado à escassez de água, devido à seca que alienou a maior parte do país de 2015 a 2017. Além de fazer uma avaliação geral do projecto, este estudo é focado em fazer a avaliação através da compreensão de como os grupos locais estão organizados e como gerem o recurso comum que eles partilham, isto é, a água. Além das medidas de adaptação implementadas pelo projecto, é crucial analisar o sistema de gestão das infra-estruturas porque é o que vai sustentar o projecto. Argumentamos que sem um bom sistema de gestão, o projecto não se pode sustentar. O modelo utilizado para avaliar o sistema de gestão da infra-estrutura de água foi o "Design Principles" de Elinor Ostrom e alguma literatura sobre projectos CBA foram utilizados para avaliar de forma global o projecto PACA.

Os resultados do estudo mostram que os projectos CBA são vitais no processo de adaptação às mudanças climáticas em Moçambique, embora cada caso seja diferente dependendo do contexto em que cada comunidade está inserida. Em geral, concluiu-se que o projecto PACA está de acordo com as características principais dos projectos CBA, bem como o sistema de gestão, estão de acordo com os "Design Principle" de Ostrom. Este estudo mostra que certos objectivos iniciais ainda não foram alcançados porque o projecto terminou há pouco tempo. Concluiu se também que estes projectos devem ser planeados melhor para que o projecto possa ser efectivo, de modo a gerar melhorias sustentáveis a longo prazo. A falta de tempo foi considerada o principal problema do projecto PACA. Muitos profissionais de CBA estão sediados em organizações não-governamentais e em várias agências governamentais, onde é difícil dedicar muito tempo ao trabalho de publicação académica. Significa que grande parte do seu conhecimento e experiência não é compartilhada tão amplamente como deveria ser. Por esta razão, o presente estudo traz as experiências de um projecto CBA em três comunidades rurais no sul de Moçambique. Além disso, esta pesquisa pode ser útil para o governo moçambicano e para as organizações que participaram do processo PACA.

Códigos-JEL: Q54

Palavras-chave: Moçambique, Alterações climáticas, Adaptação as Alterações Climáticas, Adaptação Comunitária

## Contents

Biographical Note.....	ii
Acknowledgement .....	iii
Abstract.....	v
Resumo.....	vi
List of Tables .....	ix
List of Figures .....	x
1. Introduction .....	1
2. Theoretical Framework.....	4
2.1 Introductory issues .....	4
2.1.1 Elinor Ostrom .....	6
2.1.2 Factors that influence the success of self-organizations.....	8
2.1.3 Design Principles .....	12
2.1.4 Threats to the Common-pool resources governance .....	17
2.1.5 Some solutions to the CPRs threats proposed by Ostrom.....	21
2.1.6 Common Pool Resources theory and some realities of Commons Projects in the field .....	23
2.2 Community-Based Adaptation.....	28
3. Mozambique .....	33
3.1 Country Context.....	33
3.2 Case study .....	37
3.2.1 Methodology.....	37
3.2.2 Limitations and strengths of the research.....	39
3.3 Project description .....	40
3.3.1 The cases of six Communities within the PACA project – a brief description.....	45
3.4 The three selected communities .....	50
3.4.1 Justification for the chosen communities .....	50
3.5 Context of the Namaacha District .....	51
3.6 Kala-kala community.....	53
3.7 Michangulene community .....	55
3.8 Mafuiane community.....	57

4. Results Discussion .....	61
Source: Own elaboration .....	65
4.1 “Design Principles” in the communities.....	76
4.4 Lessons learned identified from the project .....	87
Conclusion.....	89
References.....	93
Annex 1.....	110
Annex 2.....	114
Annex 3.....	117



## List of Tables

Table 1: Resource and user characteristics.....	8
Table 2: Community-based adaptation good practices.....	31
Table 3: Research questions.....	39
Table 4: Target communities from project design.....	42
Table 5: Target communities from Final Report.....	42
Table 6: Summarizing “Design Principles” in the communities: Kala-kala, Michanguele, and Mafuian.....	83
Table 7: Project objectives in the studied communities.....	81

## List of Figures

Figure 1: Ostrom's Design Principles .....	13
Figure 2: Threats to the Common-pool resource.....	17
Figure 3: Solutions to the threats.....	21
Figure 4: Banana's field destroyed by the floods in Mozambique.....	34
Figure 5: Result of the droughts and floods in Mozambique .....	34
Figure 6: Phases of project's activity in general.....	43
Figure 7: Water drinker for livestock in Mahelane.....	45
Figure 8: Rehabilitated dam in Matsequenha (right side).....	46
Figure 9: Rehabilitated dam in Matsequenha (left side).....	46
Figure 10: Plate indicating vivariums in Ponte de Lúrio.....	47
Figure 11: Small dam built in M'bolera.....	47
Figure 12: Agricultural vivarium in M'bolera.....	48
Figure 13: <i>Machamba</i> in M'bolera.....	48
Figure 14: Hand washing Laundry in Changalane.....	49
Figure 15: Rainwater harvesting (right side).....	50
Figure 16: Rainwater harvesting (left side).....	50
Figure 17: Map showing where the three communities are located.....	51
Figure 18: Map of Namaacha.....	52
Figure 19: Steps from the project's activity in Kala-kala community.....	54
Figure 20: Steps from the project's activity in Michangulene community.....	55
Figure 21: Water well built in Michangulene.....	56
Figure 22: Steps from the project's activity in Mafuiane community.....	58
Figure 23: Infrastructure inauguration day. Mafuiane Laundry tank .....	59
Figure 24: Mafuiane lift tower with two tanks and support structure for solar panels..	59
Figure 25: Illustration of the gender by percentages (questionnaire responses).....	62
Figure 26: Illustration of the educational attainment by percentages (questionnaire responses).....	62
Figure 27: Illustration of the level of knowledge about climate change by percentages (questionnaire responses – annex 1, nº1 and annex 2, nº 2).....	63
Figure 28: Illustration of climate change by percentages (questionnaire responses – annex 1, nº 2 and annex 2, nº2).....	64
Figure 29: Illustration of beliefs regarding climate change by percentages (questionnaire responses- annex 1, nº 3 and annex 2, nº 3).....	65
Figure 30: Illustration of Organizations acknowledgment by percentages (questionnaire responses – annex1, nº 4 and annex 2, nº 4).....	66
Figure 31: Illustration of PACA's acknowledgment by percentages (questionnaire responses – annex 1, nº 5 and annex 2, nº 5).....	66
Figure 32: Illustration of PACA's acknowledgment by percentages (questionnaire responses-annex 1, nº 6 and annex 2, nº 6).....	68
Figure 33: Illustration of Management Committee members by percentages (questionnaire responses – annex 1, nº 7).....	68
Figure 34: Illustration of responsibilities for the infrastructure maintenance by percentages (questionnaire responses – annex 1, nº 8).....	69
Figure 35: Illustration of management quality by percentages (questionnaire responses – annex 1, nº 15).....	70

Figure 36: Illustration of PACA’s acknowledgment by percentages, non-target group (questionnaire responses).....	71
Figure 37: Illustration of why the system was not being well managed, by percentages (questionnaire responses – annex 2, n° 11).....	73
Figure 38: Illustration of cultivated crops, by percentages (questionnaire responses – annex 2, n° 15).....	74
Figure 39: Illustration of target group satisfaction regarding PACA project, by percentages (questionnaire responses – annex 1, n° 22).....	74
Figure 40: Illustration of target group opinion regarding PACA project in other communities, by percentages (questionnaire responses – annex 1, n° 23).....	75

## **List of Acronyms and Abbreviations**

CARE	Cooperative for Assistance and Relief Everywhere
CBA	Community-Based Adaptation
CBD	UN Convention on Biological Diversity
CCAFS	Research Program on Climate Change, Agriculture, and Food Security
CCD	The Convention to Combat Desertification
COP	Conference of Parties
CPR	Common Pool Resource
DANIDA	The Danish International Development Agency
FAO	Food and Agriculture Organization of the United Nations
INGC	National Institute of Disaster Management
IPCC	Intergovernmental Panel on Climate Change
LCD	Least Developed Country
MAE	Ministry for the Coordination of Environmental Action
MITADER	Ministry of Land, Environment, and Rural Development
MC	Management Committee
MFA	The Netherlands Ministry of Foreign Affairs
NAPA	National Adaptation Action Plan
ND-GAIN	University of Notre Dame Global Adaptation Initiative
ONG	Nongovernmental Organization
PACA	Community Action Plans for Adaptation
PECODA	Programme of Environmental Education, Communication and Diffusion
SDPI	District Planning and Infrastructure Services
UN	United Nations
UNICEF	United Nations Children's Fund
UNDP	United Nations Development Programme
UNFCC	United Nations Framework Convention on Climate Change
UNISDR	United Nations International Strategy for Disaster Reduction

“All of us – governments, businesses, consumers – will have to make changes. More than that, we will have to “be” the change.”

(UN Secretary-General Antonio Guterres, 2017)

## **1. Introduction**

Nowadays, climate change is a reality. The fourth report of the Intergovernmental Panel on Climate Change (IPCC) illustrates that the climate is indeed changing (IPCC 2007). Such changes are predicted to cause natural disasters more frequent and intensively, where climate variability will be even less foreseeable with unknown exact climate change impacts (Lemos et al., 2007).

The whole world is affected by climate change, though some are more affected than others. People in low-income countries are the more vulnerable and affected by these changes. Therefore, the development strategies have to be reformulated due to climate change challenge. Development plans of action have to be developed addressing the vulnerable groups particularly to increase their resilience, which is their ability to respond to the unpredictability of climate change impacts. The capability of a system, for instance, group/communities, to adapt to climate change as well as adaptation to climate change is turning one of the most important development goals. In 2015, the Paris Agreement on climate change (Conference of Parties – COP 21) highlighted the priority of taking adaptation as an important and imperative action since mitigation efforts are not sufficient. Conforming to the UNFCCC (2015) on the 7th article (number 1) of the Paris Agreement, the global adaptation aim is to “enhance adaptive capacity, strengthen resilience and reduce vulnerability” (p. 9). To cooperate to sustainable development in the scope of climate change global goal, that is maintaining the global temperature “below 2 degrees Celsius” (p. 3). Therefore, climate change adaptation has to be “mainstreamed” in the development plan. Scholars such as Huq and Reld (2004) argue that the development is strongly connected to adaptation to climate change, and this connection has multiple levels ranging from local to global.

Along with the Millennium Development Goals, eradicate extreme poverty and hunger is Mozambique's development main objective. Thus, the opportunities for adaptation

and reduction of climate threats have an immediate link to this primary goal (Ministry for the Coordination of Environmental Affairs, 2015).

With this engagement, the Government of Mozambique has been working, in projects, along with national and International NGOs to achieve this goal. The present study analyzes the adaptation measures adopted by the PACA (Community Action Plans for Adaptation) project that is designed by the Mozambican's Government. Through community participation, it aimed at enhancing resilience in the communities. Besides other adaptation measures implemented by the project, this was based on solving problems related to water, which was the main issue identified due to the drought that devastated the region during 2015-2017. In addition to evaluating the PACA project in general, this study aims at analyzing and evaluating the kind of management that the communities are using for sustaining water infrastructure installed by PACA so that the intervention had been worthwhile; we also seek to analyze the PACA's objectives, whether they were met or not; and lessons drawn in the project will be lastly shared.

As mentioned before, some projects related to climate change mitigation/adaptation are being implemented in Mozambique. However, when the projects are finished most of them are not evaluated and announced in order to have feedback of the project's results. However, a project analysis and evaluation would be extremely beneficial either for the organizations that were in charge of the project or any other working in the Community-based adaptation (CBA) projects, and may also be a relevant research to the Government of Mozambique. Community-based adaptation remains a relatively new concept, although a trendy one, for which, comprehension, awareness, and good practice must be developed and shared broadly. Future studies and research in the environment and development field may also benefit from this research.

The conceptual framework chosen for this study is "Design Principles" by Elinor Ostrom, which will help understand and evaluate the management of the water infrastructure that the PACA project implemented in all the communities. Literature related to CBA projects and related documents to give an overall evaluation of the project will be used. PACA project's reports will be utilized as a basis to compile and provide an overview of the project itself as well as a tool to reach some conclusions for the present study, thus, answering the research questions. Because CBA projects are

implemented by practitioners and professionals, it was not so easy to find scientific studies about it.

The study consists of three sections. The first section focuses on the literature review. Elinor Ostrom Theory and her "Design Principals" as a Conceptual Framework are discussed. Lastly, this chapter briefly presents Community-based adaptation. The second section will initially contextualize Mozambique on a climate change approach. Then, the methodology used for this study is presented. Afterwards, a description of PACA project is given, then, a dive in the three chosen communities (Mafuiane, Kala-Kala, and Michangulene). The third section will be for results discussion. The questionnaires made on the field to the chosen groups as well as the reports and documents from the project will be analyzed. In this chapter, project evaluation will be performed, project's objective explained, as well as their achievements and, finally, project's lessons learned will also be stated. The last part of the thesis will be for the conclusions and recommendations. In this section, the research question will be answered.

## **2. Theoretical Framework**

The conceptual framework of this study assumes that collective action through community participation in governing their common property resources builds up Community-based Adaptation, therefore, enhancing resilience and improving access to livelihoods of the community as well as ensuring good environmental health. The most important aspect is not only the existence of infrastructure that enable individuals to adapt to climate change, but also how the people organize themselves to manage the infrastructure and the systems created to overcome the climate change problems. Infrastructure and resources alone, without a good management, do not last and do not help anyone as well (Baggio et al 2016).

### **2.1 Introductory issues**

Many households, especially in rural areas from developing countries, survive from what environment provides them, the natural resources. With changes in the environment that directly affect the natural resources, their livelihood have been threatened. Not only have the changes on the environment but also on the population number, which is increasing, resulted in resource overuse. Hence, it is important to join forces and adapt, collectively, for this new scenario.

Among several theories about collective action, one of the most outstanding and that created controversy is from Garret Hardin. In his paper, on the tragedy of the commons (1968), (cfr. Baggio et al. 2014) argue that the solution to avoid overuse of common resources is to either state control or privatization regimes. However, there have been various studies illustrating that in certain contexts, resource users themselves are capable of preventing or avoiding the tragedy of the commons, i.e, the unsustainable use of Commons (McEvoy 1986; Berkes et al. 1989; Feeny et al. 1990 crf Baggio et al. 2014s). Some scholars such as Araral (2013) argue that Hardin's theory, the tragedy of the commons, refers to cases of large scale, as national, regional and international commons and not the particular medium/small cases.

These who believe and have already proven that resource users are capable of governing their resource argue that through a solid and well-formed collective action satisfactory



results can be achieved (Ostrom 2000a). Collective action is defined as "the action taken by a group (either directly or on its behalf through an organization) in pursuit of members' perceived shared interests" (Marshall 2009, p. 96). According to Meinzen-Dick et al. (2004), there are several definitions of collective action depending on the context of application, though, they all have three key features in common: involvement of a group of people shared interests and shared and voluntary actions to achieve the common interests.

Common property resource or common-pool resource (CPR) was defined by Ostrom (1998a), as being a genre of goods expressed by natural or human-made resource system, for instance, an irrigation system, ground water basins, fishing ground, pastures, forests, or the atmosphere. Where, among these, irrigation systems are considered to be the most important type of common-pool resource. The size or characteristics of this resource system make it considerably expensive, though that does not prevent others potential beneficiaries from benefiting from it. Common-pool-resources are usually integrated by an essential resource (water, fish, timber, etc.), and because they are common resources they can quickly be subtracted triggering to overuse or congestion; hence, the action made by an individual or groups can create negative externalities for others. The core resource is to be preserved so that it can be continuously explored sustainably (Ostrom 1997a). Governments and private entities are trying hard to regulate and manage the environmental issues, natural resources, though, in many cases, the tentatives are in vain. Taking as example, fisheries that have been over-explored and make the ocean poor in food, water quality and even recovers from perturbations (Worn et al. 2009 cfr. Castillo 2015). Therefore, perception has been increasing that urges the need for alternative ways to govern the CPRs (Ostrom, 1998b). The truth is that neither the privates nor the state institutions have been broadly successful in reaching long-term management of common-pool resources. Even though it's recognized that institutions such as privates, community-based management, government, etc. are requiring to deal with the common resources issue, there is no agreement on the type of governance structure which works best (Acheson 2006). Several researchers, however, understand that it's important that privates and public institutions, together, coordinate the reciprocity between a social goal and ecosystem health (Ostrom 1990). On the other hand, others consider that in order to achieve environmental policy targets institutions

have to be endogenous (i.e., their form and their functioning depend on the conditions under which they arise and sustain) (Sarker and Itoh 2003; Grafton et al. 2007; Paavaloa 2007 cfr. Castillo 2015).

### **2.1.1 Elinor Ostrom**

Elinor Claire "Lin" Ostrom (7th August 1933 – 12th June 2012) was a Political Economist that begun a "new" era in the area of Commons studies. In 1990, she published "Governing the Commons: The Evolution of Institutions for collective action", which was a merger of different subjects such as political science, psychology, economy, sociology, and anthropology. During two decades, Elinor was keenly developed studies on Commons. In 2009, she became the first and the only woman, to date, to receive the prestigious Nobel Memorial Prize in Economic Science due to her analysis of economic governance, by demonstrating how common property could be successfully managing by groups using it (Indiana University, 2017). Her legacy to environmental governance has encouraged the scholars of the commons to comprehend why some commons can be successful managed while others fail. Therefore, scholars have been working on her institutional design principles (which will be discussed later in this study) trying to find out variables and factors that affect the results of the commons (studies from scholars such as Withheld, 2002; NRC, 2002; Cox et al., 2010; Behera, 2009; Bastakoti et al., 2010; Andersson, 2012; Gorton et al., 2009; Coulibaly-Lingani et al., 2011; Ito 2012 cfr. Araral 2013). Ostrom and others scholars that developed Commons theory were involved in diverse conservations programs, guidelines, technical notes, and legislations. Researchers on "policy matters" argue that Ostrom's work has given a huge contribution and influence on various areas of natural resource management policy around the world (Robson et al. 2014). It's possible to notice Ostrom's engagement in Commons policy by her several presentations in the World Bank about it (Ostrom, 2010a). Proof of her success and distinction was when she received that Nobel, where NGOs and experts from various places of the world celebrate this prize as well as the contribution that Ostrom's work would bring into the commons field (Dam, 2009; Schramm, 2009 cfr. Saunders, 2014).

Ostrom (1990), in her theory, argue that communities that incorporate characteristics such as trust, reciprocity and social cohesion could constitute norms and rules that empower collective action and prevent the deterioration of CPRs, i.e, she defends that self-governed systems can strongly be the solutions for the resource governance.

Ostrom (1997a) defines "self-governed common-pool resource as one in which players, who are major appropriators from the resources, are involved, over time, in making and adopting rules within collective-choices arenas regarding the inclusion or exclusion of participants, appropriation strategies, the obligation of participants, monitoring and sanctioning, and conflict resolution" (page 1). Usually, the external authorities govern the major parts of the common-pool resources and the appropriators entirely govern only a few. It's difficult to find, in the actual worldwide Governance System, resource systems that are entirely regulated by the appropriators/resource users without rules created by local, regional, national or international institutions, which also intervene in crucial decisions. Therefore, self-governed institutions mean that resources users make most but not all the rules that affect the sustainability of the resource system organization and its use (Ostrom 1997a).

The self-governance of a common-pool-resource is prosperous in cases where users create their own solutions. Solutions with fair extractions rates have to be in congruence with natural resource productivity to achieve a common benefit, and establishing specific rules that deal with free riders problems<sup>1</sup> and eventually some suspicious behaviors of taking advantage of the organization (Ostrom 2005). Since common-pool resources users are more familiarized with the resources that they deal with every day, they have better knowledge of the situation, which makes it critical to the success of the management. Therefore, by being self-governing, the CPR users can better decide, monitor and apply their own rules. Various cases of successful self-governance (fisheries, irrigation, pastures and ground water) have been found worldwide (see Ascher 1995, Bromley 1992, McCay& Acheson 1987, Peters 1994, Tang 1992, Townsend and Sutton 2008 cfr. Castillo 2015). Although these cases have been seen as types and characteristics of "successful" CPR management regimes, it is still difficult to predict where and when self-governance is most likely to be successful (Ostrom 1990).

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<sup>1</sup> "The free rider problem arises from the fact that an individual may be able to obtain the benefits of a good without contributing to the cost". Jr. Pasour (1981, p. 453)

The truth is that human activities commence stressing CPRs at the global scale (e.g., the carbon assimilation capacity of the atmosphere and oceans, fresh water availability, etc.). How to govern them is becoming crucial. Due to the fast and unprecedented changes in the climate, what was considered successful CPR governance in the past, nowadays may be not. Hence, the need for a practical understanding of the CPR's systems and their capacity to adapt in the face of such changes is critical. Ostrom herself has documented various cases of efficient and successful self-governed common-pool-resources. Some of these cases are the irrigation systems in Nepal, Arizona, Spain, Philippines; Pasture in Switzerland and Kenya; forests in India, Nepal, Colombia, Bolivia, Guatemala; fisheries in Maine and Mexico; ground water in California; among others (Araral 2013). But, her favorite example is the self-irrigation systems from Nepal. In Nepal, she found that the systems owned and governed by the resource users (farmers) are much better organized and well managed than those owned and governed by a national government institution or private institutions. The majorities of farmers in Nepal owned a small parcel of land and had similar needs related to the water for their rice yield in winter and other several crops in the spring time. Farmers in Nepal possess, for a long time, their independence for managing their resource with most of the cases successfully achieved (Ostrom, 1997a).

### **2.1.2 Factors that influence the success of self-organizations**

Some scholars agree that some characteristics of resources and their users can make self-governed systems more likely to succeed (Ostrom 1992; Baland and Platteau 1996 cfr. Ostrom 1997a). These characteristics are presented in the table below:

Table 1: Resource and user characteristics

1. Characteristics of the resource:	2. Characteristics of the resource users:
(1.1) Resources in conditions to be consumed	(2.1) Dependence on the resource
(1.2) Available information about it	(2.2) Understanding of the resource system
(1.3) Resources foreseeability	(2.3) Equality
(1.4) External boundaries	(2.4) Compliance with rules
	(2.5) Autonomy
	(2.6) Previous preparation

Source: Adapted from Ostrom, 1997a

The above factors are affected by the kind of systems, where they are inserted. The smaller systems are more likely to promote self-organization, regarding the availability of the information about resource systems, about mechanisms of conflict resolution as well as ways to support monitoring and sanctions. Hence, the likelihood of resource users to engage in systems that are more concerned with the resources are bigger than in those systems that “forget” the resource problems and where the decisions are made in a centralized manner, by central governance (Ostrom, 1997a). The interaction of the above characteristics helps analyze the cost-benefit that the users have in using the resource systems (Ostrom, 1997a).

Starting with by the characteristics of the resources (Table 1,(1.1)), if resource conditions are degraded, the cost of managing resources increases, considering that it will not engender considerable benefits for the users. However, users can be able to organize themselves in a collective action if they face a situation of necessity. But the risk, in this case, are the fast changes that occur in the environment, where the quantity of the resource can change suddenly, and the users cannot be able to deal with such changes (Libecap and Wiggins 1985 cfr. Ostrom, 1997a). The availability of information regarding the conditions of the resource (1.2) enables the resource users to be prevented in advance from changes that could eventually influence their benefits from using the resource system (Moxnes, 1996 cfr. Ostrom 1997). The resource (1.3) that is easily foreseeable is much simpler to comprehend than those that are unforeseeable. The foreseeability of the resource (1.3) can be observed in the environment where this resource exists or because the resource system itself is supposed to be constructed to control the abundance of the resource in the different seasons of the year. Some cases are difficult for the resource users to predict whether the resource is over-harvested or not. For instance, when it is related to the fishery, it is hard to predict the quantity of fishes in the ocean. (1.4) Monitoring can help understand the boundaries of the resource system .

Likewise, the characteristics of the resource users themselves (Table 1) also influence their future benefits and costs. If the resource users do not depend on the resource (2.1) for their livelihood, the efforts made by them to manage it may not be worth it. It's essential to understand collectively how resources operate (2.2) to jointly being able to

solve the problems that arise, especially because most of the resource systems are very complicated and hard to understand, e.g., the ones that are unpredictable. Resource users with plenty of alternatives and that ignore the benefits of a particular resource don't make efforts to manage it just because they know that other options are available. Usually, in self-governed system, everyone has the same interests, either user with more assets and political power or others with fewer assets. When the organizations are the users with many assets and the same interest like others (2.3), the organization is likely to succeed if they invest in the system. Usually, the users with more assets are likely to be the officials and with the power in the final decisions of the organization. However, there is a risk that these with fewer assets may be manipulated by those who have more. If users are willing to accomplish norms such as trusting each other and adopting reciprocity as their relationship inside the organization, the monitoring costs will be lower and simple to apply (2.4). If the users do not trust each other at the beginning of the project, the project cannot even start or can eventually collapse in a short time, by disagreements or bad procedures between the users themselves (Ostrom, 1992).

Autonomy's a critical aspect of the management of organizations (2.5). Organizations that are autonomous are more independent and free from the interference of external authorities, if something goes wrong inside the organization they can solve by themselves instead of appealing outsiders to solve. Indeed experience (2.6) with other local communities or other local organizations can enhance the autonomy of groups to make they own rules. Groups are more likely to accept rules and norms as well as enforce them if they are familiar with them, than to comply the new ones that are presented by the external authorities. Many cases are not easy to understand and evaluate the above factors to measure the long-term costs and benefits, due to the complexity of the resource systems (Ostrom, 1997a).

Some scholars argue that resource users will not engage in a self-organization system. Instead, they will overuse the resource until they perceive some changes in the factors above and realize the costs or benefits of organizing themselves. The external help can either increase or decrease the likelihood of the users accepting to follow rules that can enhance the living in general. Ostrom (1997a) argues that scholars and governments have to work hard and seek to understand these factors better and also how to measure them so that they can have a general agreement on how they can be managed.

Therefore, the government can help the groups self-organizing, though, on the other hand, their intervention can also cause harm to the organizations. The government can, for instance, help in situations where conflict arises between groups, so taking the role of mediator or facilitator or even participating more in the management of some resources. It's crucial that governments and scholars investigate more about these factors to find out the reasons for some factors being more costly than others.

Ostrom (1997) found that when the users perceive that the benefits from a collective action organization are very high, they are willing to participate and overcome the obstacles that can eventually exist over the years of the organization's existence. The most important aspect is not if all factors are in congruence, but users understanding of the scope of the benefits and costs are important. The truth is that given the complexity of the resource systems, and from exogenous social environment it's difficult, particularly for external authorities, to understand and measure the presented factors that influence the benefits and costs expected by the resource users (Ostrom, 1997).

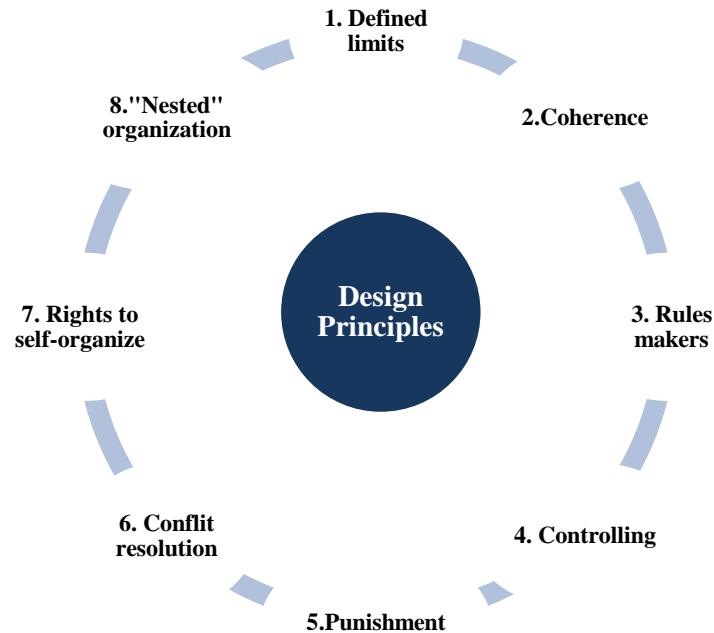
Not every self-organized system operates the same manner. Their accomplishment depends primarily on when and where they are installed; several self-governed common-pool resources systems survived for long time and others just declined. Just as there are factors that lead to self-governing, there is accordance with some rules that characterized robust self-governed systems that endure for a long time, readjusting with the different changes over time. According to where the rules are settled, they differ from one organization to another. It's almost impossible to reach a broad consensus about some rules such as those that dictate who (which person) can be part of the organization; which rights and responsibilities the constituents of the groups have in using the resources system and the resource units. Therefore, a group of "design principles" is likely to be set, characterizing the rules that most of the successful self-governed common-pool resources use (Ostrom, 1997).

### **2.1.3 Design Principles**

According to Ostrom (1999) “design principle is defined as a conception used consciously or unconsciously by those constituting and reconstituting a continuing association of individuals about a general organizing principle” (page 1). In her empirical research, Ostrom identified eight "design principles" of stable local common pool resource management, that she found in common in successful cases of Commons self-governance on her research, in Nepal, Philippines, etc. (Ostrom 1990), which was also proven by various scholars in their empirical work. Seven of the design principles seem to characterize most of the robust organized systems and the eighth principle describes bigger and heterogeneous cases. The majority of the design principles presented by Ostrom describe the most robust and long-term organizations. Ostrom's favorite example of a long-term successful self-governed in Nepal's irrigations systems was characterized by almost all the design principles. This assumption found that weak institutions adopt some of the principles and the organizations that decline completely use only very few or none of these principles (Schweik, Adhikari, and Pandit, 1997; Morrow and Hull 1996; Blomvist 1996 cfr. Ostrom 1997). Therefore, the Design Principles and explanation for each case will be presented in Figure 1 and explained below.



Figure 1: Ostrom's Design Principles



Source: Adapted from Ostrom, 1999

1) The first principle, *defined limits*, consists of defining boundaries that individuals or groups who have the privilege to use the CPR have in using it. Also the limits of the CPR itself are plainly defined (Ostrom, 1999). The limit's definition is viewed as the first step to organizing a collective action by the fact that if the boundaries of the resource and the people who have permission to use it are not clear (i.e., what is being managed, can be used and by whom) makes the management very difficult. The limits are necessary also to protect the users/beneficiaries (which have made efforts towards the operation of the collective action) from outsiders who did not make any efforts and simply want to take advantage. The intrusion can result in beneficiaries not receiving maximized results that they hope for, with the collective action. The action of the "outsiders" could destroy the resource itself (i.e., overuse) as well as the organization formed to manage it (i.e., disorganization of the management could lead to lack of credibility of the collective action) (Ostrom, 1999).

2) The second principle addresses the *coherence* between CPR's rules and the local conditions. More specifically, it is related to the rules associated with the resource units,

such as regulating time, place, technology and the quantity of the used resource. Thus, making sure if these rules are following the local conditions as well as with the rules of a provision that claims for labour, materials and eventually for money. In cases that the group that will use the resource is small and the users can manage to use the resource justly, these rules can be ignored. However, it's better to stipulate rules of how much, how and when the resources can be used, and nobody other than the users themselves can specify it. Well-defined rules allow for sustainable exploitation of the CPRs. It's difficult that the rules for a nation or a big region can be successfully used in a particular location to a specific CPR. As an example, in irrigations systems that last a long time, there is a few difference between water fees for water and for conservation activities. Though, in each system, those users who receive a higher amount of water will pay the taxes for that correspondent amount, which means different rules for each situation and each irrigation system, according to the conditions of the users, location, and resource (Tang 1992; Lam 1998 *cfr.* Ostrom, 1999).

3) Rule makers are the third design principle that refers to the importance of ensuring that resource users affected by the rules can take part in changing the established rules. According to Ostrom (1999), the CPR organizations that apply this principle are better ruled since the resource users themselves understand better which modification rules have to be done according to the changes on the resource or/and in the circumstance at all. CPR organizations that use the first three principles (i.e., defined limits, coherence between CPR's rules and local condition as well as contributions of the users in changing the rules) should be capable of establishing good rules if the users maintain the cost of changing rules low. The truth is that the existence of good rules does not mean that the users would follow them. It's easy to agree with the rules firstly established. The difficulty is to obey when the organization in operation is taking into account that strong temptation could be in place. That is why in several long-term successful CPR organizations, powerful contributions are made by monitoring and sanctioning activities. The other aspect is the fact that generations can lose the set of rules established by users over time (Ostrom, 1999).

4) The term controlling in this fourth principle refers to the monitoring activity. The monitors are those who control the CPR conditions and the user's attitude. The monitors

are usually the individuals responsible for the users or, in some situations, the users themselves (Ostrom, 1999).

5) Following the monitoring "principle" comes along the fifth design principles that address the sanctions that the users receive from the individuals responsible for the users, from the monitors or by the users themselves when one of them breaks an established rule. The sanction depends on the severity of the situation (Ostrom, 1999).

6) Conflict resolution accounts for the sixth design principles and addresses the low-cost as well as the rapid and easy access to mechanisms used by users to solve disputes between them, where existing rules are liable to the existence of conflicts. For instance in irrigation system where there is a rule that each user has to send someone to clean the channels before the rainy season; one of the users instead of sending someone fit to clean properly can send a child or even an old man, which can result in a work poorly done. And this behavior can lead others to do the same and result in damaging the system and create conflict among the users. Therefore, it's crucial for the long-term CPR institutions to establish mechanisms of resolutions, because rules can lead to misunderstanding and consequently lead to conflict (Ostrom, 1999).

7) One of the most important points to the existence of a self-organized system is the autonomy that users have to organize their system. The seventh design principle, concerns the rights that users have to organize themselves and to establish rules for their organization, where the external governmental authorities do not intervene and respect them (Ostrom, 1999).

8) The last design principle, namely "Nested" organizations, is related to large systems, where the activities such as appropriation, monitoring, conflict resolutions are organized in various and different levels of nested organizations. It's complicated, in large systems, to coordinate all aspects in only one level, but in different levels it is much better. For instance, the rules established for big and complex water irrigation will be different for only one irrigation channel. According to Ostrom (1999), it's common to find a larger farmer irrigation system with various levels of the organization, where each has a different set of rules (Ostrom, 1999).

According to Ostrom (1992), the "design principles", when driven by strong institutions, are implemented in a transparent and continuous manner to reach successful common institutions, thus, avoid damaging the environment. Ostrom's work and the knowledge helped and are helping local organizations to manage the natural resources sustainably through Common projects. The features and evidence of "design principles" can be found in various parts of Africa, for instance in Zimbabwe conservations programs as the Communal Areas Management Program for Indigenous Resources-CAMPFIRE. It was through this projects that it was found that these "rules" could work in Southern and East Africa (DeGeorgesa and Reilly, 2009). To be widely accepted and recognized, the "design principles" have been adopted by prominent and international organizations such as the United Nations and World Bank (Esmail, 1997; Agrawal and Gibson, 1999; Steins et al., 2000 cfr. Saunders, 2014). As Ostrom and others scholars demonstrate, through empirical and theoretical studies, those resource users can manage their resources and can be regularly successful. The "design principles" have been used as a basis to manage the common projects by the project designers as well as analytical and diagnostic tools by researchers (Ostrom, 1999). Ostrom (1990) suggests the Design Principles as governance regime characteristics so that resource users could undertake collective action to manage CPRs sustainably, despite various warnings because Design Principles are not the perfect solution and that such interpretation does not correspond to her study result (Ostrom,1990). However, Design principles are often viewed and used as they are (Steins and Edwards 1999; Cleaver 2002; Bruns 2007 cfr. Baggio 2016).

Even with the existence of the above principles, many self-governance Commons fail because not all of them can deal with the problems that they face over time. It's important to draw the attention to some threats that affect the sustainability of the collective actions for governing the commons. Some self-organization fails without even the users get ready, and some fail after a few years of operation; others can survive for a period but be ruined for different reasons that arise over the time. One of the causes of the failure is that, for instance, as mentioned earlier, because some organizations use only few of the design principles. Empirical researchers proved that systems of CPRs that are characterized by few design principles are more likely to fail

than those using more number of design principles (Ostrom, 1990; Morrow and Watts Hull, 1996 cfr. Ostrom, 1999).

#### 2.1.4 Threats to the Common-pool resources governance

Once again, indeed organizations that use all the design principles can eventually fail. Ostrom (1999) in her empirical study mentioned eight major threats to sustainable community governance of small-scale CPRs (Figure 2).

Figure 2: Threats to the Common-pool resources



Source: Adapted from Ostrom, 1999

"Blueprint" actions (1) usually take place when organizations, donors, groups, individuals, policymakers or/and scholars suggest a stable solution to different situations with the same problem and based on one or more successful cases as an example. Korten (1980) (cfr. Ostrom 1999) on his development work criticized the "blueprint thinking." He argued that researchers must provide data from the pilot projects and other studies from the target location to provide for correcting information that can be chosen to the project design so the development result can be achieved and the "blueprint" can be reduced. The evaluation researcher in charge of the project is supposed to measure the actual changes in the target location such as variations in the population and other essential characteristics so "blueprint" can be revised by the organization itself. Korten's critique is still very pertinent nowadays (Ostrom, 1999). The voting procedure (2) to make rules are almost the same dilemma as the blueprint thinking, where the tendency to assume that particular manner of doing the vote to form

rules is uniform and should be the same, when collective decisions are taking place. The problems arise mainly if the group is divided into two, where there are no agreements between them, making it difficult to have a rule that can please everybody or at least the two groups. When the rules are made by the majority or by the leaders instead of being agreed by everyone, lead to higher costs of monitoring and enforcement, i.e., the monitors should make more effort to make sure that the rule is enforced. On the other hand, the adoption of unanimity can lead to challenges in a long-term by the fact that, for instance, if one wants to change a rule, he must pay the cost of waiting for everyone's agreement. Thus, the voting rules system is fast when is driven by the majority and slow if it's by unanimity (Ostrom, 1999).

In today's world, changes occur very quickly (3), and every system is directly or indirectly affected by such changes. Both a standard firm that is involved in a competitive market or a self-governed CPR system is affected by changes in the technology, in the monetary economy, in the living beings populations, etc. Most of the organizations can adapt to changes if they occur gradually but, if they occur too fast, it becomes very difficult to change not only for those groups that are more vulnerable or disadvantaged but for most organizations in general. Nevertheless, the most vulnerable will be, certainly, more affected than others (Bromley and Chapagain, 1984; Goodland, Ledec, and Webb, 1989 cfr. Ostrom, 1999).

Another threat is related to the problems of rules communication/interpretation and transmission (4). Transmission of rules may fail over generations when one generation does not pass them to the next, or even the following generations do not accept the rules of the previous generations by several reasons such as the fact that the rules in place do not benefit them or they interpret the rules differently. An example can be taken from the problems of understanding the rules. If a farmer justifies that he will maintain the irrigation system according to the size of his farm, a failure can be generate in the collective action or the created system because other farmers are likely to justify the same way and that will make them proceeded in the same manner, unless, the rule is changed according to a new situation (Ostrom, 1999). For instance, in Nepal some of the irrigation-systems, sanction rules were not enforced to be paid by money but, could be by labor as an alternative. However, it was found that in some systems where the

rules were not well enforced, the tendency of the water users to avoid the spontaneous labor in maintaining the irrigation systems was more frequent (Joshi et al., 2000).

In the threat number five, external aid (5), Ostrom draws the attention to "easy money," i.e., money that donors or external authorities provide that can be a substantial threat to the long-term sustainability. This kind of procedure can harm the local institutions over time. Farmer-governed irrigations systems, for instance, are frequently sponsored by their state and, usually, the financial connection between the farmers and the supplier does not exist. Usually, the construction and the process of the irrigation system do not involve the farmers who are going to use it. Therefore, when the project is given to them, they do not have the proper consideration and can misuse the resources or give them a different purpose. In these cases, an extensive audit is needed but, generally, never occurs. If the users are involved in the process, they understand the monetary matters better, they can choose low-cost resources to the process, and the more important is that they feel engaged and responsible for the project installations and purpose. Ostrom also argues that, usually, these projects are more oriented to get authorization from people who sponsor rather than to be oriented for those who need the project, the users. The project's designers should conceive projects that are interesting politically so that politicians can argue, for instance, that the money spent was, for example, the voter's money devoted to increasing food security, hence, in a certain way, decrease the cost of living (Ostrom, 1999). One of the successful cases of the irrigation system in Nepal can be an example, a project that took place in Sindhupalchok District in 1985, where farmers agreed to attend the project and were previously informed that they would have to do most of the constructions by themselves. The budget for the irrigation system was available for the farmers, but with the condition that if they managed to save money in that step, they could win additional money to the second and even to the third level, increasing the chances to have proper installations and the best solutions for their water problems. The intention was to create incentives for the farmers to use better the funds provided and create a feeling of ownership. This study found that the system with higher involvement of the users has been better than those with a low participation of the water users (Joshi et al. (2000).

When the international aid is usually requested (6), the project design has to be done in a precise and convincing manner. Therefore in order to be approved, the project is

usually developed by experts in convincing and not by people who have knowledge of the matter and of what is happening locally. This aspect does not lead to the success of sustainable and small-scale projects, though, leads to the inefficiencies that can benefit landlords and the government itself (Ostrom, 1999).

Opportunistic behavior (7) is presented from the beginning of the process. It starts with the big amount of funds that are provided for the constructions of the large irrigation projects, for example, "There is corruption among officials and privates that are contracted to provide water. There is also corruption inside the organizations, between farmers and those responsible for the organizations in question, either to have more water or to have same advantage from the system. There is corruption among the officials responsible for the irrigations systems and the people who are not part of the organization, like "free riding," where these people get water without paying. Corruption also takes place when landowners from big farms can influence the construction of some irrigation systems, in order to benefit from them; politicians also win political support by using the power that they have to decide where and when to place the projects. Ostrom (1999) also uses some interesting theories from Robert Bates (1987) to explain some weakness of African agricultural policies. Bates (1987) (cfr. Ostrom, 1999) argued that "inefficiencies persist because they are politically useful; economic inefficiencies afford governments means of retaining political power," . With this he means, for example, the control of food price where the government is controlling the costs playing in the market. She also uses another phrase of Bates (1987) "Public programs which distribute farm credit, tractor-hire services, seeds, and fertilizers which bestows access to government managed irrigation schemes and public land, thus, becoming instruments of political organization in Africa." Meaning that everything is controlled by the politicians and the schemes that exist to create this dependence create benefits for the politicians and government retaining political power (Ostrom, 1999).

The last threat suggested was supporting large-scale systems, which is related to the large-scale institutions and the lack of support that occurs (8). While small-scale organizations are easier to manage and can easily achieve several factors of sustainable development, the large-scale systems won't easily do it. Large-scale systems need a large support. It's also essential, for long-term sustainability, to have information about

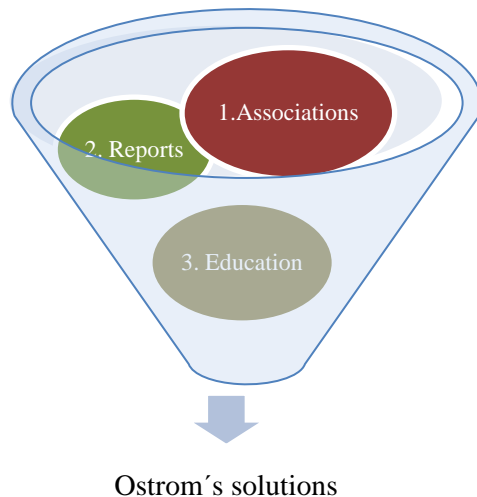


how the resources are being used over time; another important aspect is that the communities should develop scientific data about the utilization of the resource system and share among communities with the same kind of systems, which usually do not happen due to lack of support. It's also crucial, in the resolution of conflicts, that low-cost and fair methods to maintain the sustainability and avoid the destruction of the community-governed resource institutions are adopted (Ostrom, 1999).

### 2.1.5 Some solutions to the CPRs threats proposed by Ostrom

Ostrom offer some few solutions or methods to deal with the threats (figure 3) although she makes clear that there are not infallible mechanisms to address the existing threats.

Figure 3: Solutions to the threats



Source: Adapted from Ostrom, 1999

According to Ostrom (1999), the creation of associations of Community-Governance Institutions is a step on the right direction to the long-term sustainability of the organizations. Taking local participation as one or even the most important characteristic as well as being the first step to build up a self-organized organization, the constitution of associations makes sense by the fact that they can exchange their experience and eventually support each other. When NGOs promote a community organization, the support is given as long as the NGO is working in the community organization in question, though, when the NGO project finishes or turn to other

projects, the support also cease which can let them somehow adrift. When associations are created they can grow up together helping each other exchanging knowledge (e.g. exchanging different types of information or solutions that the NGO coached in each of them). They can, for example, organize meetings to talk about their projects, where solutions can be found, which, separately, would be more complicated or impossible. They could also foster training in a subject that each is more proficient. And can even develop newsletters that circulate from community to community. By doing this, Ostrom is in favor of a joint effort, an evidence of which, is her best examples of Nepal. In Nepal, farmers have created their own Water Associations that helped them exchanging experience as a right step for their system success (Benjamin t al. 1994, Lam, Lee, and Ostrom 1997 cfr. Ostrom 1997).

The exchange of the information that is necessary for self-government institutions, a meticulous analysis of comparison had to be done either in the information/reports that are exchanged between connected organizations or inside organizations with different levels , and reports are exchanged. The main reason for this important analysis is that sometimes the commons are very complex and challenging to understand so a comparative institutional research can be critical by making it easier to understand what works and most important, why it does not work (Ostrom, 1999).

Ostrom suggests that some changes should be done in Education. She argues that in high schools, professional schools as well as in universities, the lack of subjects about rural matters constitutes a huge problem, particularly, in low-income countries. Taking into account that low-income countries are more vulnerable and major parts of the households live in rural areas in poor conditions, the government should be investing more in educating people to get involved in the solutions of the complex rural problems. It's also crucial to make investments in education to the rural people themselves, considering that in these countries, usually, the majority is illiterate, which makes it difficult for them to understand and find the best solutions to manage their natural resources (Ostrom, 1999).

### **2.1.6 Common Pool Resources theory and some realities of Commons Projects in the field**

Although the CPR theory is being applied around the world, some complicated concepts intrinsic to this approach such as participation, empowerment, social learning and social capital are, in practice, difficult to integrate into the commons projects. There is a general agreement that the communities can be able to organize themselves and manage their resources, but the problems arise when the theory is put into practice (Saunders, 2014).

The CPR theory has been applied in the world wide as a basis to support the commons projects, diverse factors such as politics and economics are associated with the adoption of this theory in African countries since the 90s (Pinkney, 2001 cfr. Saunders, 2014).

In the political perspective, Commons projects are promoted by different institutions such as environment ONGs, state institutions, international development organizations, to improve and increase the local sustainability and development, giving the responsibility of the resources to the locals. Even though the "commons projects" and goals differ depending on their context, they are usually planned with limited resources and time in order to modify resource use rules. The "commons projects" are often moderated by the Government, in cooperation with NGOs and donors (Levine 2007). In African countries, for instance, the "commons projects" are almost never exclusively managed by resource users; they mainly include some way of management between state institutions/government and local communities (Roe and Nelson, 2009).

It's noticeable that many experts in Commons policy field around the world use the CPR theory to inform the development and other related to Commons such as conservations and adaptations projects (Metha, 2000). Because the theory that informs policy can be a handy instrument in the sense that it bring together and facilitates complex information, making the process easier to spread and share. In the political field the "design principles" facilitate because are simple and can be easily replicated and accepted when it is time to "sell" the projects to the funders or to the institutions that have to give the endorsement to the projects (e.g., national governments/states) (Li, 2002). Scholars have found that the "design principles" are used as an institutional pattern to the commons projects (Steins and Edwards, 1999; Cleaver and Franks, 2003; Evans, 2004;

Husain and Bhattacharya, 2004; Agrawal, 2005; Li, 2007; Quinn et al. 2007 cfr. Saunders, 2014).

Scholars also argue that there is plenty of problems that arise when methods of simplified or design projects that are copied from one to another are used. Nevertheless, Ostrom had proved that the “design principles” can work worldwide, but she was meticulous regarding the seriousness of the local context, drawing attention to the fact that the success of the commons projects depends on the conditions found in the target area (Ostrom 2010).

The CPR theory views the individuals as tools to be crucially analyzed based on their choices and attitudes that have to be critically embedded and evaluated (Bardhan and Ray, 2006 cfr. Saunders, 2014). Therefore, the Commons project is based on beliefs that individuals that are under rules which limit and control their behaviors will make better decisions based on their best own interests. According to these beliefs, the purpose of the commons projects is to link the CPR "design principles" to the local context, making them fit together to successfully achieve the aims of the commons resource projects, taking into account that each project has its objective. The important point of the institutional theory is to change and overcome the problems that occur when, in the same time, individual work by themselves as well as collectively to get positive results for themselves and the environment (North, 1990).

This kind of procedure seems to be easier but, in practice, it's hard. In the rural communities and the Common's context, the kind of political economy that sets up the relations between people is defined by the power that individuals have over the others. These relationships and dependencies dictate the access and opportunities that people have such as economic and political opportunities, the possibility to have a land, a job, religious status and health care (Walley 2004 cfr. Saunders, 2014). Thus, when problems arise, people are more likely to resort the informal path, solving the matter among the group than resorting to the formal institutions (Cleaver, 2002). This conclusion came up from a conservation project in Tanzania-Zanzibar, Jozani-Pete Village, where people did not resort to formal institutions when problems arise, claiming that did not want to create conflicts and divisions in the community (Saunders, 2011). In situations where the rules were infringed, the solutions where overcome on face to face informal discussions. What reinforces that people do not only concentrate

on economic aspects, such as the resource use, but also in the relationship with each other, which defines the harmony and balance in the community (Cleaver, 2000). Although the acceptance to be included in the project design, the social norms such as values, attitudes, and behavior, taking into account the local context, make it difficult to understand how this point of the CPR theory can be implemented, particularly, in the multi-institutional dimensions (Saunders, 2014).

The other problem found by Tsing et al. (2005) (cfr. Saunders, 2014) is related to the “assumption of community homogeneity” which has been one of the problems of the commons projects - It has been assumed that some communities are homogenous but others may not be. For instance, in the case of forest resources, as a common pool resource, a study was carried out by Leach et al. (1999) in this field where individuals have the same objective (to sustainably use the forest resource) but with different interests, some are interested in the firewood, others in the medicines and so on. In the conclusions of this study, the complexity and difficulties facing the commons projects due to the existence of different interests is noticed. The truth is that, in reality, to build up the collective arrangement, one needs to cross and fit different values and interest to reach a common consensus to make it worth (Saunders, 2014).

Project planners have to study all the differences among the resource users (age, gender, wealth, tribe, interests, education, etc.), and make them work together to have a good and consistent CPR norms that create and ensure a sustainable collective action towards a common pool resource governance goal. Hereupon, it is found that the groups are all heterogeneous. Heterogeneity, therefore, even in small-scale projects, is viewed as complicated to manage. However, the CPR theory advocates that the solution to overcome this problem is by spending more time to set better rules towards settling these difference and reach a common understanding (Varughese and Ostrom 2001). It's hard also to find resource users, and they are usually penniless, that can afford to spend time developing rules and maintaining them without having continuing "external help." What converges with one of the biggest issues of the commons problems, which are the fact that the Commons project planners usually have limited time and monetary funds that enable them to make long-term rule to support the projects (Saunders, 2014).

It's tough to have a successful self-governed project without understanding the socioeconomic situation both "historically and spatially" of resource users, about the

decision they do over the resources use (Agrawal, 2003). Wherefore, the projects cannot be well designed and achieve positive outcomes if the norms that govern individuals in the particular context are not well understood. According to Baldus (2009), the fact that projects do not have a local origin does not mean that they will automatically fail, they rather fail because are weakly designed or the existing local social structures, cultures and beliefs are not evaluated.

Ostrom (2007) explain the "self-organizing" process as the process that combines various aspects from rational choices. From the way that resource users make individual and collective decisions, to the way that they adapt, and the lessons that they learn from the mistakes that they do over time in order to reach more efficient and effective institutions. Thus, commons institutions grow through a social learning process. Additionally, she argues that, throughout the projects, cooperation in congruence with the implementation of rules will set aside the "rational egoists" which will increase the good outcomes from collective action and the success of the institutions (Ostrom, 2007). This argument seems that institutional evolution arises in congruence with resources and its conditions characterized by "endogenous" influences which make this argument less clear, and in some way explain why the "design principles" are more likely to suit small-scale rural institutions that are homogenous and remote. Poteete and Ostrom (2002) summarize this point of view by defending that when it's noticeable that how CPR theory influence over time the institutions that grow efficiently when the norms converge leading to the positive use of resources. Polycentrism was an approach by Ostrom (2010a) (cfr. Saunders, 2014) as "an analytical and normative concept that reflects an emphasis on the ability of groups of individuals to work out problems for themselves while embedded in complex diverse institutional arrangements, including the coordinating structures of government" (p. 645) This concept the CPR theory which believes that small departments or various small organized units can work jointly are crucial to constitute strong institutions capable of dealing with institutional as well as environmental changes. However, this concept is still being developed and studied; doubts still exist on how to find a balance between the kind of policy to follow and the local autonomy of projects. The polycentrism dominant idea is to connect the community actions to other levels of government through schemes of representation.

Still, concerns arise when community heterogeneity comes up and whether can fit in such multi-scale systems (Nelson and Agrawal, 2008).

Subsequently, the CPR theory, in Commons projects, state that all the process since the prior arrangement to build collective action to develop effective institutions is based on trust. In short, there are three essential explanations of why it's more likely to establish confidence in small-scale projects. The first is that it's easier to observe each other's intentions. The second is that participants fear to be removed from the group. And the third is because members are close to each other and share similar roles (Platteau and Abraham, 2002).

CPR theory does not focus on power nor political matters but on spontaneous changes that are jointly agreed upon and accepted, which will support the collective action. However, some scholars argue that Commons institutions can be created with different intentions, viewing it from a political view, rather than the preservation of natural resources intentions such as territory interests, indigenous rights even political interests (McCay, 2002 cfr. Saunders, 2014). Regarding this, different project motivations and a lack of responsible notion that there is a resource problem that needs a proper institutional solution can drive in an incongruence between an ordinary project and the own commons projects (Saunders, 2014).

Another issue in the commons project to take into account is the "elite capture." It is a broad problem, despite the warning that the CPR theorists have done to the democratic procedures to the proper governance of the commons projects (Robbins, 2012). It's not expected that the commons projects solve the historical contextual political and cultural problems that result in social inequalities.

Some fundamental assumptions of CPR theory and how they turn into problems to the commons projects are discussed here. However, Ostrom (2000a) frequently advise to not take "design principles" as an instrument that foresees social reality of unknown contexts, though, they are usually misunderstood. The CPR theory, with its foundation on trust or social capital, is a basis to project efficiency, but what the project planners forget is that this can give rise to conflicts regarding power struggle in the commons projects, which can cause confusion and destabilize the collective action (Saunders et al., 2010). The assumption that social capital can be easily created and developed has been seen as a big problem in the various fields of public policy discussions (Li 2002).

CPR though, does not specify how to operationalize them or interests that users have to the projects. It's still a query among commons scholars and experts whether the commons projects can develop an "evolutionary" way through institutional organizations (Saunders, 2014).

In short, it can be argued that, more than only concentrating on the “solution and implementation of problems” as the most of the commons studies do, it was fundamental in this study made in this dissertation to look at the other side of the issue, the reality of the Common projects although it was not possible to address here all the existing problems.

The message here is not the fact that CPR theory is not a useful management “instrument” or that the planning does not have to exist, but it's the fact that it was observed in the commons projects that more consideration must be given to many important aspects of the resources management. Furthermore, the important concepts that are the sustainable basis for the commons projects as "participation," "social capital," "social learning," “monitoring,” "community and empowerment" have to be taken into consideration and well analyzed before the projects are designed, in any target community. Based on the principle that the better informed about the local context, the better the project designers will know how to deal with the local situation (i.e., resource users and community members).

"It is not enough to say the institution is useful, one must still ask the question: useful for whom?"

Deleuze (2004, p. 20) (cfr. Saunders, 2014, p.649 )

## **2.2 Community-Based Adaptation**

Some Community-Based Adaptation projects are sometimes implemented jointly with the Common's governance project, because the adaptation measures are related to the management of natural resource which the community depends on, for instance water. According to Agrawal (2003), the combinations of these two projects enhance resilience. Moreover, CBA and managements of Commons have the same essential characteristics, for instance, participatory approach, so facilitates the understanding and



development of the overall context. For this reason, CBA notions will be briefly presented.

Considerable effort is being made to adapt to climate change, different actors have been financing several projects around the world, and the focus was mainly on a top-down approach and the projection of policy solutions (Wilbanks and Kates, 1999; Reid et al., 2009 cfr. Bryan et al., 2013). However, this kind of approach was not enough, as mentioned before it's crucial to go down to the local level where the changes occur. Likewise, the reference to local level here meant to the rural communities level where most of the times are the more vulnerable, particularly in African countries. Climate change adaptation on a community level can enhance resilience and allow interconnection between communities and institutions that can help them overcome climatic disturbances (Adger, 2003).

Community-based adaptation (CBA) to climate change is based on giving support to local people on adaptations strategies, where people themselves will bring up their needs and decide the best strategies. Usually, it's focused on local social, economic and political aspects in situations of poverty and consequently vulnerability, as well as climate risks such as floods and droughts. This concept arose in the early 2000s and had formed several projects in low-income countries, where local groups work along with international organizations or international nongovernmental organizations (NGOs) (Forsyth, 2017).

Bryan (et al., 2013) defines Community-Based Adaptation project to whatever group or community engaged with climate change adaptation that presents the following features:

- It's crucial that it has collective actions as well as social capital (trust, reciprocity, and cooperation);
- Include climate change long term provisions and the consequent adaptation solutions;
- Include local awareness related to climate change and “risk management” action planning;
- Praise local responsibility and autonomy on the strategy process;
- Must be by community's necessities and their first needs;
- Must reduce poverty and increase livelihoods.

“The difference between a community-based adaptation project and a standard development project is not principally in the intervention, but in the way the intervention is developed: not what the community is doing, but why and with what knowledge” (Ensor and Berger, 2009:231 cfr. Markovic, 2016, p. 25).

CBA arise due to three determinants aspects: first because of the efforts made on mitigations to deal with climate change were not enough and is increasingly recognized the role of adaptation on the efforts. Second is because development practitioners had the needs to comprehend the "social vulnerability" and "local contexts of poverty" when were working in the adaptation programs in low-income countries. The third aspect was emerged because of the Community-Based Natural Resource Management approach; researchers found that could be a "solution" empowering local people to implement adaptation strategies (Forsyth, 2013 cfr. Markovic, 2016). Adaptations strategies have to be more than only one approach (both top-down approach or bottom-up approach<sup>2</sup>) has to be collective, is necessary to have interaction at various levels (from the community up to the international) as well as good network and interconnection between organizations (Adger 2003).

CBA projects are designed or initiated by the local communities; however, the majority is by the government, NGOs or donors, but it as to ensure the community participation in all the process (since the conception up to the execution activity) (Bryan et al., 2013).

As reported by CARE (2014) there is no a standard template of good practice for CBA projects. The project is designed according to the context that the target community is involved. However, after several case studies and projects implemented by CARE (2014, p. 7) was found out “five key lessons” that function and can be enforced in different contexts (table 2):

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<sup>2</sup>"Top-down approach implementation refers to policies created by government, which tend to rely on expert technical advice, which is then operationalized at the local level. A bottom-up approach recognizes the importance of local context and other actors, particularly those at the level in which adaptation is operationalized, in formulating and implementing policies" (Urwin and Jordan, 2008 cfr. Fenton et al., 2014, p. 389)

Table 2: Community-based adaptation good practices

Five key lessons for CBA good practice	Description
Adaptability	It is very important to built up adaptive capacity in a effective and sustainable maner.
Equity	Taking participatory and right-bases vision will guarantee an effective and sustainable project's result. Will also ensure that the inequalities and vulnerabilities are not exalted thus, achieving the most vulnerables one.
Partnership	it's important to make partnership for the sucess of a CBA project. Establishing working links with the civil society can support the local to the national level requisit for CBA projects operate. Partnership can exist since the support to the infrascutures constructions until, for instance, the funding.
Combination with formal process	Communities or groups should combine their individual or even groups informal adaptations strategies into the formal governmental strategies so efforts can be thus, maximized.
Ensuring local capacity	The exaltation of the participatory approach among the stakeholders help to built adaptive capacity thus, fostering the project's logenvity and ensuring the project's surviving after the implementing organization leave.

Source: Adapted from CARE, 2014

Due to the level of poverty in low-income countries, which can difficult some interventions, some scholars (Davies et al., 2009; Heltberg, Siegel and Jorgensen 2009 cfr. Bryan et al., 2013) argue that it's essential that CBA projects must be combined with other projects such as, development, social protection, disaster risk reduction and so on, thus, resilience can be raised. Therefore, if the combination does not occur can lead to a waste of efforts as well as the dilapidation of resources and can even result in conflicts among the target community (Lipper and Pelling, 2006).

Lessons learned in each CBA project can be shared or "upscaled," for other practitioners to analyze the results of each situation and the benefits of the participatory approach, which is the base of the CBA. Even though, CBA is focused on the local context and each case it's different from another (Forsyth, 2017). Robin Means from the World Bank express that "scaling up CBA isn't a question of only stitching together a "patchwork quilt" of local initiatives . . . the real contribution of the CBA movement in recent years has been to show that top-down approaches to adaptation will also founder if they fail to connect with the felt priorities of those most vulnerable to climate change" (Mearns, 2011, p. 1). ActionAid reinforced this "it is important not to portray poor people simply as victims, but as people who, with the right support, can assume a degree of responsibility for, and find solutions to, local environmental degradation.

Science should help people understand themselves as both parts of the problem and part of the solution" (Rahan et al. 2010, p.10 cfr. Forsyth, 2017, p.14).

### 3. Mozambique

#### 3.1 Country Context

Mozambique, the *pearl of the Indian Ocean* as it is kindly called, is located on the south-east coast Africa continent, with an area of 799,380 square kilometers and with approximately 28 million of population. Regarding climate, it has a tropical to subtropical climate, including some semi-arid areas in the southwest of the country. It's a country with different landscapes where lowlands can be found on the east side and mountains it's more on the west side. The country has a beautiful coastline, of almost 2,700 Kilometers (IrisAid, 2016).

According to the IPCC report of 2007, a trend of increased temperature has been observed in Mozambique (IPCC 2007). Temperature has raised by 0,6C degrees annually, 1960-2006, and has estimated to increase of within 1,0 to 2,8C degrees by the decade 2060 (McSweeney et al., 2010). Estimations reveal that the climate can turn out even more extreme, referring to severe drought (figure 5) and floods (figure 4) seasons that are becoming more frequent. Especially the droughts nowadays. The central and south regions are probably to be the more susceptible to the climate risk (INGC, 2009). According to McSweeney (2010), the average annual precipitation has diminished at a proportion of 2,5mmm monthly in the period from 1960 and 2006. Although has raised notably the precipitation in the massive events where is more notable in December to February which is the wet season in the country. INGC (2009) also indicates that the rainfall period has been starting later on and the drier periods have been longer.

Mozambique ranks 153 out of 181 countries in the ND-GAINindex<sup>3</sup>(2015), wherein 2012 was ranking 142, and 2014 was 151, concluding that is gradually increasing. This index indicates separately rank on vulnerability and readiness: in 2015 Mozambique was ranking 31st most vulnerable and 32nd least ready country. ND-GAIN measures vulnerability by taking into account different sectors for a sustainable-life: food, water, health, ecosystem service, human habitat, and infrastructure. Readiness dictates the

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<sup>3</sup> ND-GAIN index compile a country's vulnerability to climate change and other global challenges in combination with readiness to improve resilience. Source (ND-GAIN, 2017)

capability that countries have to adapt by considering economic, governance and social factors of a country related to the speed and efficiency to adapt.

Mozambique's vulnerability is not only because its geographic position that exposes it to high temperatures, sea level rise and extreme events that are increasingly intense and frequent as is the case of cyclones, prolonged floods, and droughts. But, also owing to its socio-economic matters that drive to worse climate change effects and diminishes the ability of the population to manage and adapt. The country's rural areas rely on agricultural practices (mostly rainfed) and natural resources that can and are severely affected by climate change. The dependence on this factors for livelihood jointly with high levels of poverty and weak level of education<sup>4</sup> restrain the rural population from doing better agricultural options (i.e., more sustainable) as well as to discover other different forms of livelihoods (World Bank, 2011).

Figure 4: Banana's field destroyed by the floods in Mozambique



Source: FAO, 2017

Figure 5: Result of the droughts and floods in Mozambique



Source: CCAFS, 2014

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<sup>4</sup> Adult Literacy (2015): 58, 8% (male 73, 3%; female 45, 4%). Source Index Mundi (2017)

Mozambique's CO<sub>2</sub> emissions are one of the lowest in the world, with 0, 1 tons per capita per year compared to the global average that is 4, 9 tons (CDKN, 2017). Nevertheless, according to UNISDR (2009) projections, Mozambique is the third African country most affected and susceptible to risks from various weather-related hazards. The reason why in Mozambique climate policies and plans of action it is a hardly prioritized adaptation rather than mitigation actions (Arnall, 2006 cfr. MFA, 2015). Hereupon, the country show in the clearest way how the least culpable by climate change will be the most affected by it rather than who is responsible for it. Moreover, showing the clear reason why the high-income countries have the responsibility and the moral obligation to aid low-income countries to deal with climate changes impacts, which are in a general way the effect of their actions (Hervey and Blythe, 2013).

The year 2015 was overwhelming to Mozambique and especially to its rural population which relies on agricultural and natural resources to survive. The mighty El Niño was the cause of this catastrophe. The south region of the country was the most affected in which less than 50% of the precipitation fell in 2015 (IrisAid 2016) and extend up to March 2017, and is estimated that around 1,5 million people in the south were affected by it during this period. The reason why the Government along with private and civil society were jointly working to fight against such climate impacts enhancing resilience, raising projects of community aid (Portal de Angola, 2017).

Regarding national governments and policies, Mozambique has some ratified documents related to environmental issues, as (IrisAid, 2014):

- UN Convention on Biological Diversity (CBD) that has resulted in the National Bioversity Strategy and Action Plan validated in 2003;
- The Convention to Combat Desertification (CCD);
- The Kyoto Protocol which has purposed its NAPA in 2008;
- UN Conventions on Ozone Layer Protection and Wetlands (IrisAid, 2014).

Referring also that in 2010 was approved by the government the Gender, Environment and Climate Change Plan. In 2012, Mozambique launched National Climate Change Strategy for 2013-2025 which its overall objective is to "*establish guidelines for action to build resilience, including the reduction of climate risks for the communities and the national economy and promote the development of low carbon and green economy,*

*through their integration in the sectorial and local planning processes”* (IrisAid, 2016, p.7), among other documents that the country has been launched. These are some examples that Mozambique's Government it's aware of the country's risks and vulnerability, and that in a certain way expanding its actions to combat climate change impacts (Hervey and Blythe, 2013).

The National Adaptation Action Plan (NAPA), approved by the Council of Ministers in 2007, was the first official document approaching adaptation to climate change in Mozambique. As the Least Developed Country (LCD), Mozambique proposed its NAPA to the United Nations Framework Convention on Climate Change (UNFCCC) in July 2008. The NAPA document conforms UNFCCC instructions was accomplished based on a participative process where the most vulnerable and needy actors (e.g., regions, groups, households, communities) to climate change were considered and consulted (Irish Aid, 2016). NAPA constitutes the instrument through which Mozambique, like other low-income countries; identify their priority activities to address the urgent and immediate adaptation to the adverse effects of climate change (TESE, 2015).

Therefore, NAPA establishes a framework to various interested stakeholders and integrates four priorities (Irish Aid, 2016):

- a) Strengthen the early warning system;
- b) Increase the ability to the agricultural producers to deal with climate change;
- c) Reduce the climate change impact on the coastal zones;
- d) Manage the water resources in the scope of climate change.

The arising of NAPA was extremely important in the means that has placed the climate change into development agenda and since has attracted the high-level attention of various interested stakeholders (Serra et al., 2012).

Both, the planning instruments and the economics increasingly accept that climate change could be the primary barrier to the country's development and therefore, aggravate the poverty stage of Mozambican's people and the country itself (Serra et al., 2012).



## **3.2 Case study**

Here starts the practical part of the study, where was chosen for the effect a Community-Based Adaptation Project in Mozambique and where the main adaptation measure was to solve problems related to water scarcity.

### **3.2.1 Methodology**

First of all, will be explained how will be the methodology to lead this study and so, answer the research question.

For this study will be used a combination of two methods to determine the final results and therefore, respond to the research questions.

Was used the documents analysis as qualitative and questionnaires as qualitative and quantitative methods for data collection. (Snap Surveys, 2017)

"Document analysis is a systematic procedure for reviewing or evaluating documents" (Bowen, 2009:27). In this research method data is "examined and interpreted to elicit meaning, gain understanding, and develop empirical knowledge" (Corbin and Strauss, 2008 cfr. in Bowen, 2009:27). Literature that borders on climate change, adaptation to climate change, natural resource management, and community-based climate adaptation was used. Scientific journals that address the nexus between the four important issues in recent times will be consulted. Practical publications focused on CBA projects (good practices) will also be consulted. Will also be analyzed some documents and reports related to the selected Project for the case study. The literature will be obtained from publications by scientific institutions, journals, groups, and networks, which will be indispensable to conduct the present study and answer the research questions appropriately. The document analysis is usually complemented with other qualitative research methods, to enhance the credibility of research (Bowen, 2009). In this case were used questionnaires as a qualitative and quantitative research method as a complement for the document analyses. "Questionnaires can be classified as both, quantitative and qualitative method depending on the nature of questions. Specifically, answers obtained through closed-ended questions with multiple choice answer options are analyzed using quantitative methods, and they may involve pie-charts, bar-charts,

and percentages. Whereas responses received to open-ended questionnaire questions are analyzed using qualitative methods, and they include discussions and critical analyses without a use of numbers and calculations" (Research Methodology, 2017).

Inquiries will be made to the target community to gather sensibility of the results of the project on the field from the community's perspectives. For that were made questionnaires to two different groups, namely the target group (the group that was affected by the project) and the not-target group (the group that was not affected by the project).

These questionnaires will also be very necessary to understand better the Commons Governance that is linked to the infrastructure management. Were planned to do 120 questionnaires but, in the end, 88 were possible. With an average of 20 questionnaires to the target group to each community (which were all made successfully) and 10 for the not-target group. The questionnaires were made with different types of questions, as "open question questionnaires" that are open questions so people can express themselves and present some information that was not wondered. With "multi choice question" this kind of question was pertinent to understand some questions and prove whether the communities' members are familiar with some terms. And "dichotomous questionnaires" for the facility that this kind of questions provides (yes or no) as well as assertiveness (Research Methodology, 2017).

Will also be made semi-structured interviews (via skype, email, telephone, and WhatsApp) with the staff members of the organizations who are driving the project. Was also interviewed others organizations and people linked to the project, where particular attention was given to Kulima who was the national NGO that works along with TESE (Portuguese NGO).

So, the following table intends to clarify which data and method will be used to answer the research questions:

Table 3: Research questions

Research question	Data collection	Source of data
1. Project evaluation	Documents analyses	PACA reports, CBA, Commons Governance, climate change literature
	Questionnaires	Stakeholders
2. Objectives met or not..and why	Document analyses	PACA reports
	Questionnaires	Stakeholders
3. Lessons learned	Document analyses	PACA reports

Source: Author

### 3.2.2 Limitations and strengths of the research

Limitations were found to PACA documents accessibility. Because the Mozambican Government has designed the project and some documents are "confidential" was not allowed the access to some documents. TESE ONG approved the present study, and the reports and document were made available by them according to the level of "confidentiality."

Another limitation was financial. Due to the lack of funds, I could not afford to go to Mozambique to make the questionnaires by myself that is why had to be someone else. As mentioned before was planned to make 120 questionnaires, though, only 88 were made at the end. This occurred because is very difficult to bring community people together. The meeting had to be done on the weekends, especially on Sundays, because people are more relax of their busy working week. The field work has to be conducted in three weekends because one weekend was to each community, taking into account that the questionnaires were a bit long because was important to understand several aspects and because it's difficult to question rural people. People are not interested in participating in a meeting unless there is a snack. For that, snack was offered in each community. Even so was impossible to reach some people to fill the questionnaires number previously planned. Where was found more difficulties to make the questionnaires was to the not-target group because they are not much interested in the PACA since the project has not covered them.

Was also found limitations to interview some important stakeholders, namely MITADER, which is the entity who designed and launched the project. This limitation is considering one of the worst because was crucial to include in this study MITADER's opinion and analyses regarding the project.

The strength found, was the one about the field work. As written above, lack of funds

inhibited me from traveling to Mozambique to do the research work. However, would be very difficult for me to do the research work by myself because most of the community members have difficulties in understanding and speaking Portuguese. The research field was made by a reliable person who is familiar with the community members and with the local language. This person was also interviewed for the study because of his knowledge of the project and the overall context of the communities. According to TESE information, even when the project was being implemented was sometimes needed to call a translator.

Another aspect that can be considered as strength is the fact that this study was allowed by TESE that is the NGO in charge of the implementation of the project in the field, thus, facilitates the understanding the overall project as well as the matters on the field.

### **3.3 Project description**

The present study case it's based on a project promoted by the Mozambique's Government, concretely the Ministry of Land, Environment, and Rural Development (MITADER) in the context of climate change.

The project arises in the scope of the broader Development's strategic aim that the Mozambican government has in the context of the challenges of facing the climate change adaptation in the Mozambican territory, namely the National Climate Change Strategy and the National Adaptation Action Plan (NAPA) (PACA, 2016a). Moreover, the project arises in a period where Mozambique was facing a severe drought as a consequence of El Niño, which affected further the south of Mozambique causing an extreme water scarcity particularly to the rural communities that are more vulnerable and sensible to these extreme climatic phenomena (Jornal Noticias, 2016).

PACA (Community Action Plans for Adaptation) project is promoted by the MITADER, implemented by CAOS - Butterflies and Sustainability, financed by the Portuguese Carbon Fund, with the support of the Portuguese Environment and Camões Agency, Institute of Cooperation and Language, IP. "This project is focused on the implementation of community adaptation action plans Impacts of climate change

(PACAs) through the simplified Participatory budgeting<sup>5</sup> for the identification of local mechanisms to address the variability and the elaboration and implementation of community actions for the Resilience mechanisms, with emphasis on Community adaptation strategies Based on the sustainable management of community livelihoods" (PACA, 2017).

Thus, the PACA project aims to contribute to the integrated implementation of direct focused on the priority adaptation needs identified in the NAPA in nine of the 300 communities identified as priorities in the Government's Five-Year Program 2010-2014 for the implementation of the Environmental Education, Communication and Disclosure Program (PECODA) and were noted for being particularly vulnerable to the impacts of climate changes. The PACA's overall goal is to increase resilience to the impacts of Climate change of the nine target localities through the implementation of adaptation measures, allowing for greater resilience and the path to a green economy (PACA, 2016a).

For this purpose, the team constituted by TESE/KULIMA was selected by CAOS/MITADER to give technical assistance for the implementation of adaptation measures in the chosen communities (PACA, 2016a). The PACA project officially started in November 2013, though, the pilot phase only began in October 2015 because during that time according to (TESE) were doing needs assessments in the field. The project has finished in December 2016 (PACA, 2016b).

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<sup>5</sup> "Participatory budgeting (PB) is a process of democratic deliberation and decision-making, and a type of participatory democracy, in which ordinary people decide how to allocate part of a municipal or public budget. Participatory budgeting allows citizens to identify, discuss, and prioritize public spending projects, and gives them the power to make real decisions about how money is spent" (Chohan, 2016)

The target Communities that were presented on the project design were the following:

Table 4: Target communities from project design

Project phase	Region	Province	District	Community
Pilot phase: 6 months	South	Maputo	Namaacha	Mahelane
				Matsequenha
	North	Nampula	Érati	Ponte de Lúrio
Final phase 8 months	North	Zambézia	Morrumbala	Pinda
	Center	Manica	Manica	Messica
			Guro	Nhamassonge
	Center	Sofala	Maringué	Senga-Senga
			Marromeu	Malingapansi
	North	Niassa	Mecanhelas	M'bolero

Source: Adapted from PACA, 2016a

On the pilot phase, the selected communities were covered according to the initial proposal. However, the final phase has undergone alterations on the pre-selected communities, changing completely the target communities pre-defined. According to Kulima information, this change occurred because of the political conflict that was happening in the country at that time. Those communities first selected were situated exactly in the worst places, that is, where the conflict was very intense. The center and north region was where the conflict was happening, particularly in Maringué which was the base of one of the parts. That is why the final phase was in communities located in the south, where the political conflict was not happening.

The target Communities that were covered by PACA project and were presented in the Final Report were the following:

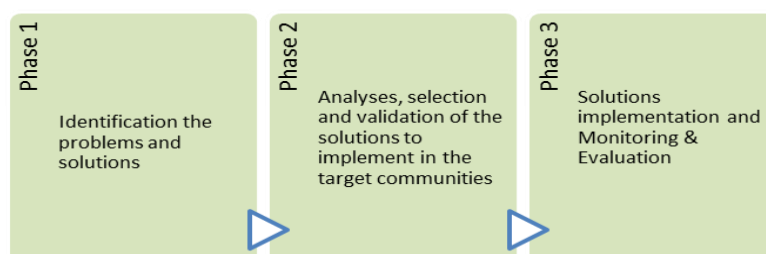
Table 5: Target communities from Final Report

Project phase	Region	Province	District	Community
Pilot phase	South	Maputo	Namaacha	Mahelane (A)
				Matsequenha (B)
	North	Nampula	Érati	Ponte de Lúrio (C)
	North	Niassa	Morrumbala	M'bolera (D)
Final phase	South	Maputo	Namaacha	Changalane (E) Namaacha Village (F) <b>Kala-Kala (G)</b> <b>Michangulene (H)</b> <b>Mafuiane (I)</b>

Source: Adapted from PACA, 2016b

According to PACA(2016a), the project activities were organized in three phases:

Figure 6: Phases of project's activity in general



Source: Adapted from PACA, 2016a)

In the first phase, the preliminary information gathering activity served as a basis for sustaining the formulation of the options that have been implemented in the field and thus to adequately addressed to the identified needs. Information gathering consisted of collecting and analyzing of the existent information that the local institutions and others data's holders could provide to, generally, support the understanding the community's context development, their livelihoods (with a focus on agricultural and livestock) and the level of their climate change vulnerability. Starting from auscultation Participatory budgets in the preliminary phase of the project, sought to involve in the collection of primary information district of the sectors associated with the typologies of projects to be implemented, Community leaders and other sensitized farmers interested in participating actively in the implementation phase of the project. This involvement had as main objectives the presentation and discussion of the priority and definitive choice and, with the purpose of promoting its adhesion to the projects. More concretely promote financial sustainability and foster the sense of ownership of the project by the communities they have benefited, thus providing a continuity of longer-term benefits. With the purpose of collecting data, the questionnaire was prepared and distributed to the community and other stakeholders. Helped to understand the environmental problems of each community thus, enabling the team to developed technics of adaptation measure for each single community (PACA, 2016a).

One of the fundamental basic criteria for the project's design in the communities consisted in defining the direct beneficiaries of the actions since the solutions had a limited capacity to meet all the needs of all inhabitants of the target communities and thus adequately respond to their expectations. Together with due consideration of other criteria limiting the characteristics of "Nuclear" options, this definition was as always made jointly with CAOS, MITADER, local institutions, among other stakeholders considered relevant. The beneficiaries corresponded to a set of Farmer's who were already organized and accustomed to working collaboratively and dealing similar situations - such as, for example, an association or cooperative - about production and food security. In cases where there were no organized associations, the solution was to work with Community leaders or with emerging farmers, always with the participation of the employees of local institutions (TESE, 2015).

Based on both the diagnoses carried out in the participatory budgets and the information collected, the adaptation measures have been adequately measured and oriented towards the communities, taking into account their characteristics and capabilities (TESE,2015). The Design of Projects was the phase activity in which all the aspects related to the options to be implemented in each of the communities were defined and detailed. Was taken into account the pre-defined guidelines and specifications within the framework of the PACA, as well as the results of the prior analysis of the current situation in each of the target Communities. This activity ensured the relevance of the interventions for the problems and also the viability of the recommended actions (TESE, 2015).

In the second phase, it has always been seeking to promote the participation and community involvement in all proposed activities contributing to the development of ownership of projects and stimulating, also its good maintenance and continuity, after the end of the project (TESE, 2015). Were provided training sessions in each community to help them to manage the installations as well as, in the agriculture area in the scope of climate change. On the participation process, the main problem that the communities brought up were the matters related to the water supply for agriculture as well as for community consume. Phase three was about the implementation of the solutions as well as monitoring and evaluation (PACA, 2016a).

Following will be presented, summarizing, the adaptation measures implemented in six out of nine target communities, in order to allow an overview of what was done in all



communities giving a broader view of the different kind of adaptation measures implemented by PACA project.

### **3.3.1 The cases of six Communities within the PACA project – a brief description**

In Mahelane community (A) located in Maputo-Namaacha, the project endured six months, which two months were to implement the measures and four months to monitoring and support's evaluation. The Total of the target-group was 1340 inhabitants (PACA, 2016a).

The principal activity was the construction of a water supply system. Which include: water well; watering tank, installations of two water reservoir; fountain<sup>6</sup>; and a water drinker for livestock (Figure 7); Others activities were the definition of the management model of the new infrastructures and training of the Management Committee (CG) for its proper operation and maintenance; training of farmers for conservation agriculture and the sustainable management of water required for agricultural activity (PACA, 2016a).

Figure 7: Water drinker for livestock in Mahelane



Source: PACA, 2016a

In Matsequenha community (B) located in Maputo-Namaacha, the project endured six months in this community, which two months were to implement the measures and four

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<sup>6</sup> Referring that all the fountains and installations that provide water implemented by the project were not “drinkable”, the reason why close by the fountains exist a sign with “WATER NOT TREATED” (PACA, 2016a).

months to monitoring and support's evaluation. The Total of the target-group was 1060 inhabitants (PACA, 2016a).

Principal activity in this community consisted on the rehabilitation of a degraded dam ( Figure 8 and 9) that existed on the river Movene that due to its state was not operational. Other activities were related to the definition of the management model of the new infrastructures and training of the Management Committee (CG) for its proper operation and maintenance; training of farmers for conservation agriculture and the sustainable management of water required for agricultural activity (PACA, 2016b).

Figure 8: Rehabilitated dam in Matsequenha (right side)

Figure 9: Rehabilitated dam in Matsequenha (left side)



Source: PACA, 2016a

In Ponte Lúrio (Érati-Nampula) ( C )the project endured six months in this community, which two months were to implement the measures and four months to monitoring and support's evaluation. The Total of the target-group was 4500 inhabitants (PACA, 2016a).

The “nuclear” action in this community consisted of building three agricultural vivariums. Because one of the vivariums had been built nearby one existing water well, were only needed to make two more for the other two remaining vivarium (Figure 10). The water wells are working with manual pumps; were distributed 12.000 vegetable seeds. Because pests, namely locusts severely attacked this community, the project helped them fighting against this invasion with natural repellents. The project fomented the yield of Piri-Piri (i.e., chili or scientifically calling *Capsicum Frutesens*) as a natural manner to repel the locusts; the Piri-piri was planted among the cultures. For that was also distributed Piri-piri seeds, in place were training capacities about Piri-Piri's benefit as well as different forms of how to cultivate Piri-Piri to this end (PACA, 2016a).

Other activities were the definition of the management model of the new infrastructures and training of the Management Committee (CG) for its proper operation and maintenance; training of farmers for conservation agriculture and the sustainable management of water required for agricultural activity as well as commercialization (PACA, 2016a).

Figure 10: Plate indicating vivariums in Ponte de Lúrio



Source: PACA, 2016a

In Niassa province, specifically in M'bolera community (D), the project endured six months in this community, which two months were to implement the measures and four months to monitoring and support's evaluation. The Total of the target-group was 500 inhabitants (PACA, 2016a).

The “nuclear” actions as adaptation measures in M'bolera were the construction of a small dam (Figure 11); one water's reserve; built of the agricultural vivarium (Figure 12) and a constitution of new *machambas*<sup>7</sup> (Figure 13) along by the Ricuembe River. Here were distributed different types of vegetable seeds. Other activities were the definition of the management model of the new infrastructures and training of the Management Committee (CG) for its proper operation and maintenance; training of farmers for conservation agriculture and the sustainable management of water required for agricultural activity as well as commercialization (PACA, 2016a).

Figure 11: Small dam built in M'bolera

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<sup>7</sup>Machamba - Mozambique agricultural land for family production, arable land (infopédia, 2017)



Source: PACA, 2016

Figure 12: Agricultural vivarium in M'bolera



Source: PACA, 2016a

Figure 13: *Machamba* in M'bolera



Source: PACA, 2016a

Regarding Chagalane community (E) (Maputo-Namaacha) the project endured three months in this community, which two months were to implement the measures and one month to monitoring and support's evaluation. The Total of the target-group was 1500 inhabitants. (PACA, 2016b).

Principal activities were two: a) Construction of a water supply system (water well; watering tank, a fountain, and a hand washing laundry (Figure 14)) and b) Distribution of inputs such as seeds (maize, pumpkin, owls, common bean, Nhemba beans, cassava cuttings, Orange Squash Sweet Potato Branch) plastic watering can, framer's spray,

drying machine. Other activities were once again, the definition of the management model of the new infrastructures and training of the Management Committee (CG) for its proper operation and maintenance; training of farmers for conservation agriculture and the sustainable management of water required for agricultural activity (PACA, 2016b).

Figure 14: Hand washing Laundry in Changanane



Source: PACA, 2016a

In Namaacha Village (F) located in Maputo province, in Namaacha district the project endured three weeks for implementation and monitoring. In this village, the process was different because MITADER wanted to cover a large number of people. In this sense, MITADER opted for the "Rainwater harvesting" (Figure 15 and 16) in Namaacha Village, with the objective of collecting rainwater through gutters and tanks, structures built in 12 public buildings in the village, which presented problems at the level of water supply. This intervention is intended to sensitize the rural and urban population of the Namaacha district to the importance of water saving and possible alternatives to increase the availability of water for different uses. The total of the target-group was approximately 2.850 people. In this village, the activities consisted on: Construction of rainwater harvesting systems in the public buildings of Namaacha Village; definition of systems maintenance and use plans, capacity building of users of public buildings for climate change and sustainable water management (PACA, 2016b).



Figure 15: Rainwater harvesting (right side)

Figure 16: Rainwater harvesting (left side)



Source

(PACA, 2016b)

### **3.4 The three selected communities**

After having been given a brief vision of what was done in the six communities, the three communities chosen for the study will be presented in more detail in the next pages.

#### **3.4.1 Justification for the chosen communities**

The three selected communities for the case study were part of the Final Phase of the PACA project which started in August 2016 and finished in December 2016 (PACA, 2016b): Mafuiane Community, Kala-Kala Community and Michangulene Communities which are part of Namaacha District.

Figure 17: Map showing where the three communities are located



Source: Adapted from Google Maps

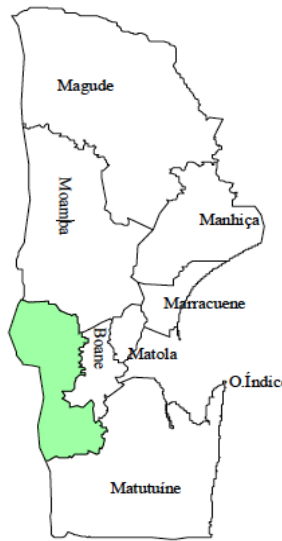
This selection was made randomly, though, taking into account their location and the travel costs at the time of the research work. Because the communities are located near Maputo has facilitated the access which by car were possible to reach all the three communities easily and with less money spent. Were also consulted members of KULIMA and TESE NGOs, that in a certain way agreed that the three communities could be the best choice considering the characteristics of the communities and the impact that the PACA project had on them.

Following will be contextualized the district where the communities belong, the Namaacha district.

### 3.5 Context of the Namaacha District

Namaacha district belongs to Maputo Province in southern Mozambique, the capital of the country to be more precise (Figure 18). The principal town is Namaacha city. Namaacha district, from 76 km's from Maputo city, is located in the southwest of the province, and borders with Moamba District in the north, Boane District in the east, Matutuíne District in the south, and with Swaziland and South Africa in the west. The area of the district is 2,196 square kilometers (MAE, 2005). According to Population Census 2007, it has a population of 41,914 inhabitants which 50, 7% are women and 49, 3% men (INE, 2013).

Figure 18: Map of Namaacha



Source: MAE, 2005

According to MAE (2005), 40% of the population of the district was younger than 15 years and 44, 3% of the population were illiterate (52, 5% stands for women and 36% for men), mostly women. 63% of the population speaks Portuguese and is mostly composed of men given to their greater insertion in school life and the labor market. The climate is tropical humid, fluctuating with altitude, the average annual rainfall is 751, 1 millimeters (MAE, 2005). According to MAE (2005) Namaacha district is divided into two administrative posts and eight communities' distributed among them:

Administrative post of Namaacha - Namaacha Village subdivided in five communities: Kala-kala, Chimachuanine, Impaputo, Mafuiane, and Matsequenha.

Administrative post of Changalane - Communities of Changalane, Goba Station, Mahelane, and Michangulene

Just like the country, agriculture is the basis for the economy of Namaacha district. The main crops are horticultural's, corn, peanuts, beans, sweet potatoes, bananas, and cassava. The main livestock is cattle, goats, sheep, chickens, ducks, and pigs that are for family consumption and commercialization. Fishing is also one of the main livelihoods in Namaacha as the district benefit from some rivers as Movene, Mabenga, Calichane, Impaputo and Umbeluzi River as well as Reserve of PequenosLibombos (MAE, 2005). Affected by excessive demand for land from the city of Maputo, Namaacha has been the scene of several conflicts linked to land tenure. (MAE, 2005).



MAE (2005) refers that 89% of the population uses unchanneled water, which means that they get water from fountains, wells, and rivers.

*"The climate of the region, the quality of the land and the existing water resources are favorable and can boost the development of agricultural activity. However, the occurrence of cyclical droughts and pests, and the lack of seeds and agricultural implements are factors that limit the development of the sector"* (MAE, 2005, p. 45). El Nino that plagued the south of Mozambique came to confirm the previous statement. Maputo province was one of the most affected ones by the drought since 2016 up to 2017 due to this phenomenon (UNICEF, 2017).

### **3.6 Kala-kala community**

The first community that will be analyzed will be Kala-kala (G), which belongs to the administrative Post of Namaacha.

The intervention in this community endured three months, which two were stands to the implementation of the adaptation measures and one was to the monitoring and support of evaluation. According to PACA (2016b) the project's objectives were:

General objective - *"contribute to increasing the resilience of the Kala-Kala community to climate change impacts, including through increased availability of livelihoods and better food and nutrition security, breaking the cycle of poverty and reducing the incidence of climate change"* (PACA, 2016b, pp. 24).

Specific objective - *"Increase capacities and access to water and the means for diversification and sustainability of sources of income associated with subsistence agriculture."* (PACA 2016b, pp. 24)

The Target group to who's the implementation was destined were 1000 inhabitants from the Mabenda neighborhood in this community.

The project's activities were divided mainly into three steps:

Figure 19: Steps from the project's activity in Kala-kala community



Source: Adapted from PACA, 2016b

Implementation of adaptation measures accordingly with pre-established needs through the participatory process was the first step.

The principal or "nuclear" option as adaptation action was to build a community water supply system which consisted of the repair of a manual water well pump and the construction of a community water supply system and an agricultural vivarium. Was used solar panels to provide electricity to the electric pump that pulls water from the water well. Was also provided a fence in the area to maintain the infrastructure security (PACA, 2016b). In addition to the infrastructure built, the community changed the agricultural vivarium (pre-established in the project design) to seeds, material for agro-processing and drying. Were distributed 205kgs seeds of maize, pumpkin, okra, common bean, Nhemba beans, cassava cuttings, Orange, Squash and Sweet Potato; 21 plastic watering cans, one framer's spray 8L, one drying machine. (PACA, 2016b)

Step two was to define the management model of the new infrastructures and training of the Management Committee (MC) for its proper operation and maintenance. Was defined an MC by the communities and was also created a management model with the intent to ensure the proper and good use of the systems installed so that can last and be used for a long-term period. A timetable was established in the management model related to water use for agricultural purpose throughout the day, as follows: from 6 am to 9 am and from 3 pm to 5 pm. It's charged the rate of 50 meticais (MZN)<sup>8</sup>per month to each family. The charged amount is intended to several factors related to the installations such as maintenance of the system, payment for the security of the system (solar equipment) and reserve fund. Furthermore, was fundamental capacitating the managers about the use of the equipment. Therefore, training sessions were held. As a manner to help the MC to the future management and maintenance of the system, was

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<sup>8</sup> Mozambican currency - Metical

created the Management Manual for the Kala-Kala Community Water Supply System (PACA, 2016b).

Training sessions it's related to the third step. The PACA intervention also considered empowering farmers to disseminate knowledge and skills across some thematic areas to maximize the results of the project. To get better attention from the participants and to facilitate, the training sessions were held informally and collaboratively. Took place courses in conservation agriculture and agro-processing. The monitoring and evaluation took place in a month, as was established (PACA, 2016b).

### 3.7 Michangulene community

The community of Michangulene (H) it's located in Administrative Post of Changanane in Namaacha District.

The intervention in this community endured three months, which two were stands to an implementation of the adaptation measures and one was to the monitoring and support of evaluation. Project's objective was also (PACA, 2016b):

General objective - *“contribute to increasing the resilience of the Michangulene community to climate change impacts, including through increased availability of livelihoods and better food and nutrition security, breaking the cycle of poverty and reducing the incidence of climate change”* (PACA 2016b, pp. 33).

Specific objective - *“Increase capacities and access to water and the means for diversification and sustainability of sources of income associated with subsistence agriculture”* (PACA 2016b, pp. 33).

The Target group to whose the implementation was destined were 50 inhabitants. The project's activities were divided mainly into three steps:

Figure 20: Steps from the project's activity in Michangulene community



Source: Adapted from PACA, 2016b

The first step was related to the implementation of adaptation measures accordingly with pre-established needs. The principal or "nuclear" option as adaptation measure implemented was to build a community water supply system which consisted of construction of a community water supply system and an agricultural vivarium. The community water supply system included the construction of water well (Figure 21) nearby the Umbeluzi River; the building of a watering's tank with 10.000 of capacity; and water drinker for livestock that can approximately feed 250 bovine animals per day. As well as Kala-kala was used solar panels to provide electricity to the electric pump that pulls water from the water well. In this community was also substituted the agricultural vivarium by seeds, material for agro-processing and drying. Was distributed 205kgs seeds of maize, pumpkin, okra, common bean, Nhemba beans, cassava cuttings, Orange, Squash and Sweet Potato; 21 plastic watering can, one framer's spray 8L, one drying machine. (PACA, 2016b)

Figure 21: Water well built in Michanguelene



Source: Paca, 2016b

On the second step was also defined an MC by the communities and created a management model with the intent to ensure the proper and safe use of the systems installed. Differently, from Kala-kala the timetable established in the management model related to water consumption for agricultural purpose throughout the day, was: from 5 am to 7 am and from 4 pm to 5 pm. With a cost of 100 meticais (MZN) per month to each family. The charged amount is intended to several factors related to the installations such as maintenance of the system, payment for the security of the system

(solar equipment) and reserve fund. Managers were capacitated about the use of equipment (i.e., composition, operation, maintenance and troubleshooting of hydraulic and photovoltaic systems; Adoption of good practices in the management of the water infrastructures); therefore, training sessions were held. As a manner to help the MC to the future management and maintenance of the system, was created the Management Manual for the Michangulene Community Water Supply System (PACA, 2016b).

Step three was related to training sessions to empowering farmers to maximize the results of the project. Training sessions in conservation agriculture and agro-processing were given. The monitoring and evaluation took place in a month, as was established (PACA, 2016b).

### **3.8 Mafuiane community**

The community of Mafuiane (I) is the third and last community to be approached, which it's located in Administrative Post of Namaacha.

The intervention in this community lasted three months, two for implementation of the adaptation measures and one was to the monitoring and support of evaluation. Project's objective was the same as the two first communities, Kala-Kala and Michangulene (PACA, 2016b):

General objective - *“contribute to increasing the resilience of the Mafuiane community to climate change impacts, including through increased availability of livelihoods and better food and nutrition security, breaking the cycle of poverty and reducing the incidence of climate change”* (PACA 2016b, pp. 14).

Specific objective - *“Increase capacities and access to water and the means for diversification and sustainability of sources of income associated with subsistence agriculture”* (PACA 2016b, pp. 14).

The Target group to whose the implementation was destined were 600 inhabitants. The project's activities were divided mainly into three steps:

Figure 22: Steps from the project's activity in Mafuiane community



Source: Adapted from PACA, 2016b)

The “nuclear” option, adopted in the first step, as adaptation measure implemented consisted of the construction of a community water supply system which allowed providing water to the farm's irrigation and for livestock (PACA, 2016b).

The community water supply system included the construction of water well close by the Umbeluzi River. Was built a watering's tank, 4L's capacity; implementation of a high tower for the placement of two water reservoirs to save space, with the capacity of 5 liters each that supply the water fountain with two taps for human consumption. However, the system does not provide the treatment of water for human consumption, so this warning is duly indicated on the fountain "WATER NOT TREATED." As well as Kala-kala and Michangulene were used solar panels (Figure 24) to provide electricity to the electric pump that pulls water from the water well. In this community, the prediction was to build a water drink for livestock. However, the community substituted the adaptation measure by tanks for washing clothes (Figure 23) claiming that cattle breeders use to take their livestock to the river as a source of water even more, which was not common that animals were so close to the people in the community. They also substituted the agricultural vivarium by seeds, material for agro-processing and drying. Were distributed 205kgs seeds of maize, pumpkin, okra, common bean, Nhemba beans, cassava cuttings, Orange, Squash and Sweet Potato; 21 plastic watering cans, one framer's spray 8L, one drying machine (PACA, 2016b).

Figure 23: Infrastructure inauguration day. Mafuiane Laundry tank



Source: PACA, 2016b

Figure 24: Mafuaine lift tower with two tanks and support structure for solar panels



Source: PACA, 2016b

Was also defined a Management Committee, in the second step, by the communities and created a management model with intend to ensure the proper and safe use of the systems installed so that can last and be used for a long-term period. The timetable established in the management model related to water consumption for agricultural purpose throughout the day, was: from 5 am to 7 am and from 4 pm to 5 pm. With a cost of 50 meticaís (MZN) per month to each family. The charged amount is intended to several factors related to the installations such as maintenance of the system, payment for the security of the system (solar equipment) and reserve fund. Managers were capacitated about the use of equipment (i.e., composition, operation, maintenance and troubleshooting of hydraulic and photovoltaic systems; Adoption of good practices in the management of the water infrastructures). Therefore, training sessions were held. Management Manual for the Michangulene Community Water Supply System was created to help the management group to deal with the equipment in the future. In

Mafuiane, as step three were also held training sessions in conservation agriculture and agro-processing. Here the monitoring and evaluation normally took place in a month, as was established (PACA, 2016b).



#### **4. Results Discussion**

This chapter looks at collected data!

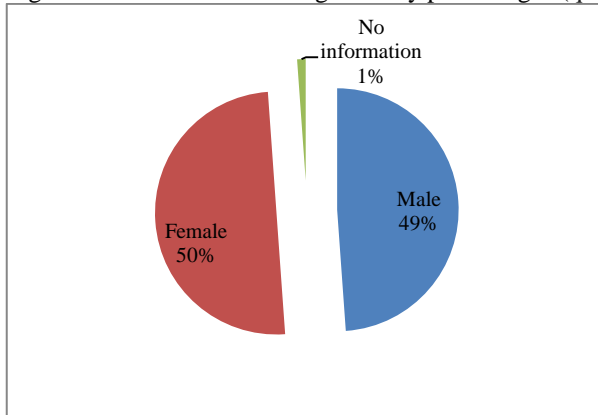
A description of the questionnaire results will be presented first. The priority will be to the most important issues of the orientation and direction of the study, as well as for answering the research questions.

As mentioned earlier, 120 questionnaires were planned, but only 88 were successfully done. In each community, questionnaires were prepared for the target group that was covered by the PACA project and another for the non-target group that was not covered by the PACA, but it was considered important to understand their point of view and impression, concerning the project. Therefore, two questionnaires were administered in each community for two different groups.

As a first step, the results of the questionnaires will be described in a general manner, covering the two groups (target group and not-target group). The comparisons and descriptions will be made between the two groups individually. Target group" or the "not-target group" refer to 3 communities (Kala-kala, Michangulene, and Mafuaine) at the same time. That is, "target group" refers to the three communities at the same time as well "not-target group." When it is necessary to address one community individually because of some commentary or to arguing about a particular case then will be done so. It is important to mention that question number 9 from the annex 1 – Target Group, was not here described because the results were not trustfull.

Concerns were raised about the age of each respondent to understand the age range, as well as to understand the context in which each questionnaire was answered. Thus, the respondents had ages ranging from 20 to 60 years. Where, most are peasants or farmers , with an average of 2-7 children each. Gender was found to be balanced; the questionnaire covered 50% of women and 49% of men:

Figure 25: Illustration of the gender by percentages (questionnaire responses)

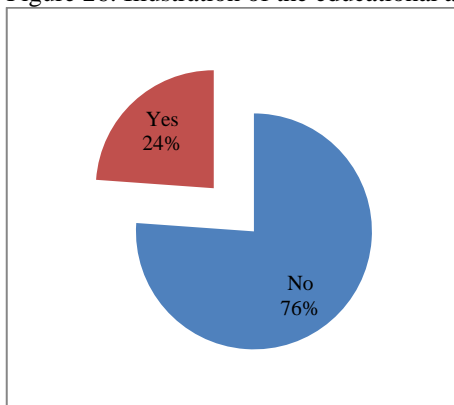


Source: Own elaboration

According to Kulima information, when the project was taking place, it did not have many differences regarding gender. It was more or less balanced! However, Kulima information found that in the rural communities, in the south of Mozambique, the society is very sexist. The man leads family, and the women are in charge of the domestic activities and also taking care of the children. When asked about the existence of many women in the project, Kulima information shows that it is because the communities are located at the border with two countries, South Africa and Swaziland. Men go and seek better working opportunities. That is why, as men work outside, women take charge and lead the families.

It was also important to understand the education level, which was found that 76% of the respondents can write and 24% cannot:

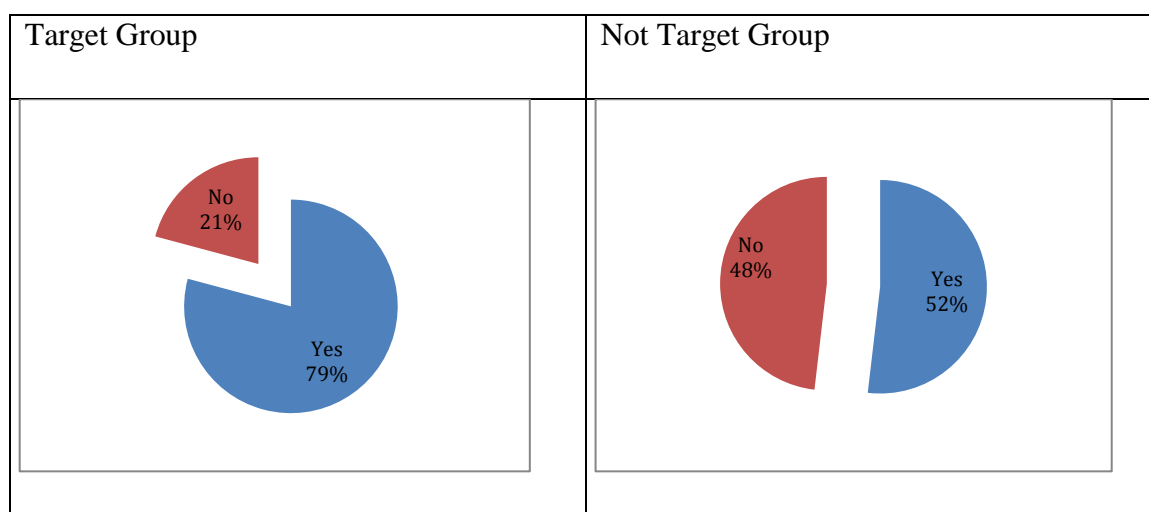
Figure 26: Illustration of the educational attainment by percentages (questionnaire responses)



Source: Author

The first question asked for both groups was regarding their understanding about climate change. 72% said that know "what climate change is" and 28% responded that they don't know.

Figure 27: Illustration of the level of knowledge about climate change by percentages (questionnaire responses – annex 1, n°1 and annex 2, n° 2)



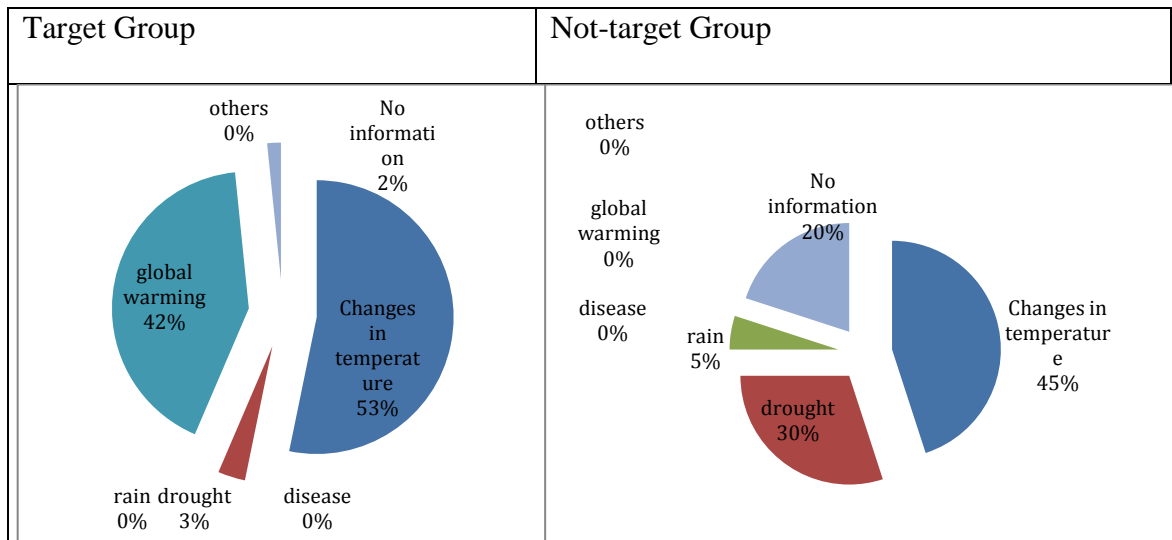
Source: Own elaboration

However, by analyzing the answers separately, it was found that the number of people that “know” what climate change is, in the target group is higher than the nontarget group. Was found that on nontarget group, 48% of respondents do not know what climate change is and 52% knows. However, on the target group, it was found that 79% of respondents know what climate change is and only 21% do not. In this question, it can be noticed or concluded that the difference on the groups can be because of the impact of the training that happened regarding climate change on the project. Regarding the people that answered “no” can be related to the justification found on the PACA report (2016a) that is very difficult to make local people understand the complex concept of climate change.

In order to have a better view of their understanding of climate change, they were asked to define it, giving them some choices and also an opportunity to answer freely but, nobody did it. Half of the respondents answered that climate change is “changes in temperature”; 32% answered that is global warming, though, not because they know global warming definitions but, they associate with the constant heating felt in the

environment; which is why 10% answered “drought” by the drought that plagues the region.

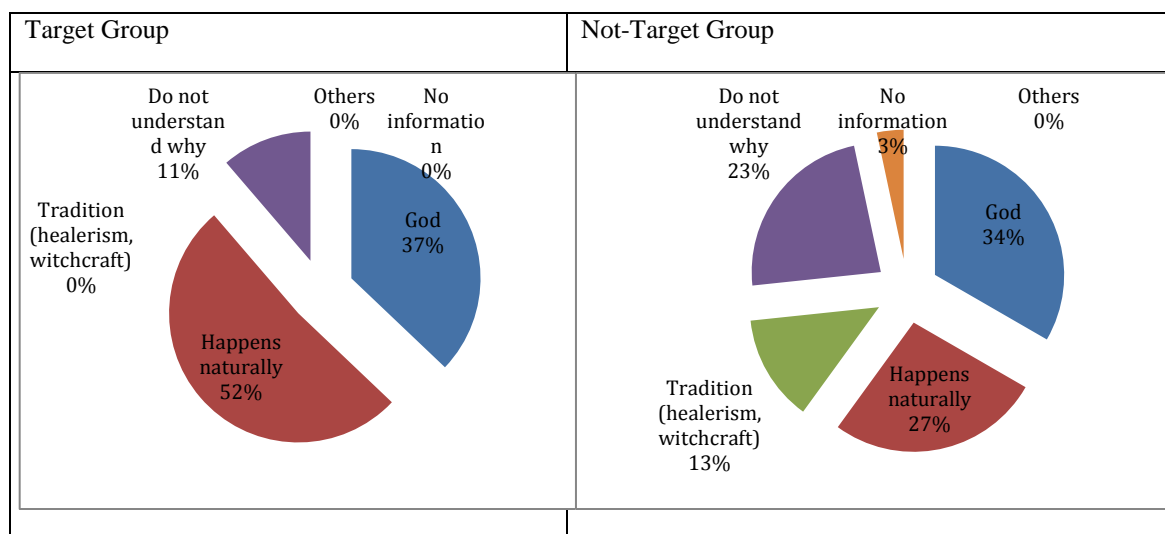
Figure 28: Illustration of climate change by percentages (questionnaire responses – annex 1, n° 2 and annex 2, n°2)



Source: Own elaboration

To complement these questions was asked, in both questionnaires, about their beliefs about climate change. 61% of respondents believe that is an action of God; 16% believe that it happens by obscurantist reasons and 12% think that it happens naturally and 10% do not understand why. What was found interesting analyzing the groups individually was that on the target group’s questionnaires nobody answered that believes in obscurantist reasons but, on the not-target groups 13% choose this answer. This difference can also be related to the PACA intervention, where the training affected in a certain way.

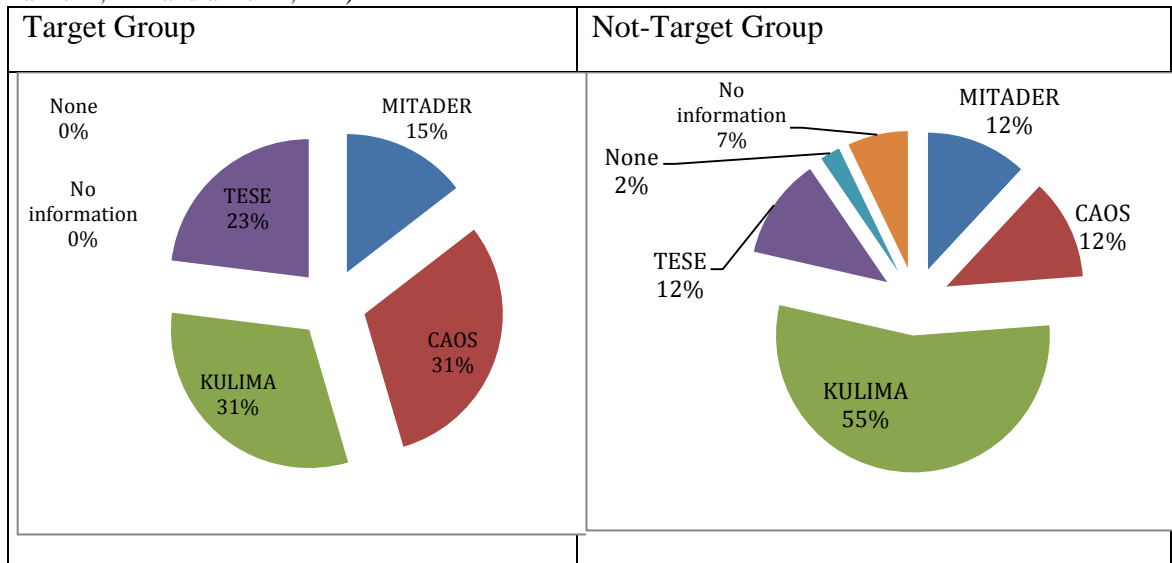
Figure 29: Illustration of beliefs regarding climate change by percentages (questionnaire responses- annex 1, n° 3 and annex 2, n° 3)



Source: Own elaboration

Another common question was to find out if they knew the organizations that were involved in the project. This question was to understand if they understood the "ponderosity" of the project as well as to understand if they are used to have the previous contact with such organizations. Was found out that Kulima was the best known because it is an ONG that are operating throughout the country usually in rural areas.

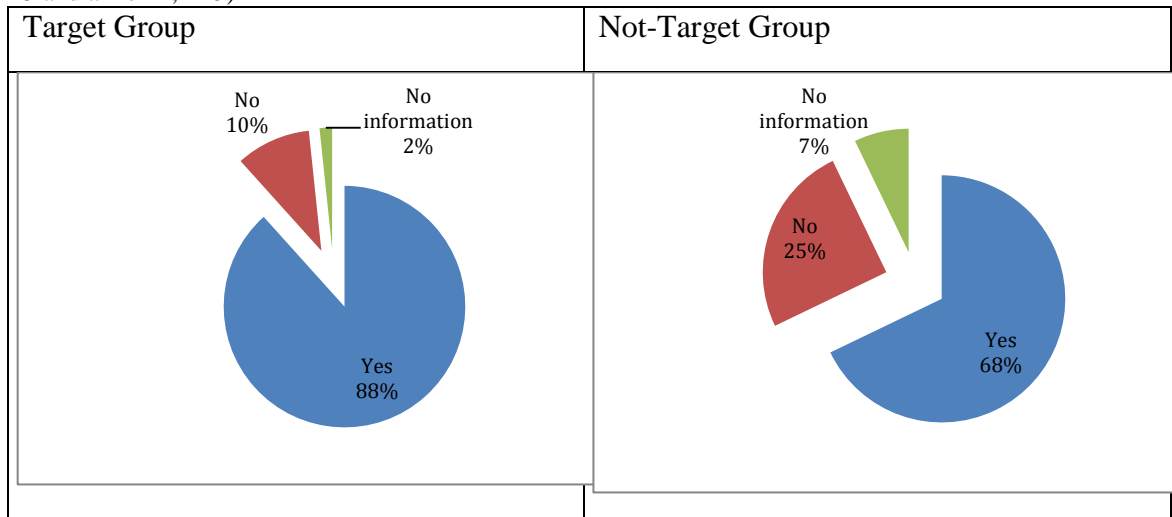
Figure 30: Illustration of Organizations acknowledgment by percentages (questionnaire responses – annex1, n° 4 and annex 2, n° 4)



Source: Own elaboration

To understand the dimension and extent regarding PACA project were asked if the respondents knew about the PACA project or the water project that occurred in each community in 2016. For that, 82% answered that knew about it, and 15% responded that not and 3% gave no information.

Figure 31: Illustration of PACA´s acknowledgment by percentages (questionnaire responses – annex 1, n° 5 and annex 2, n° 5)

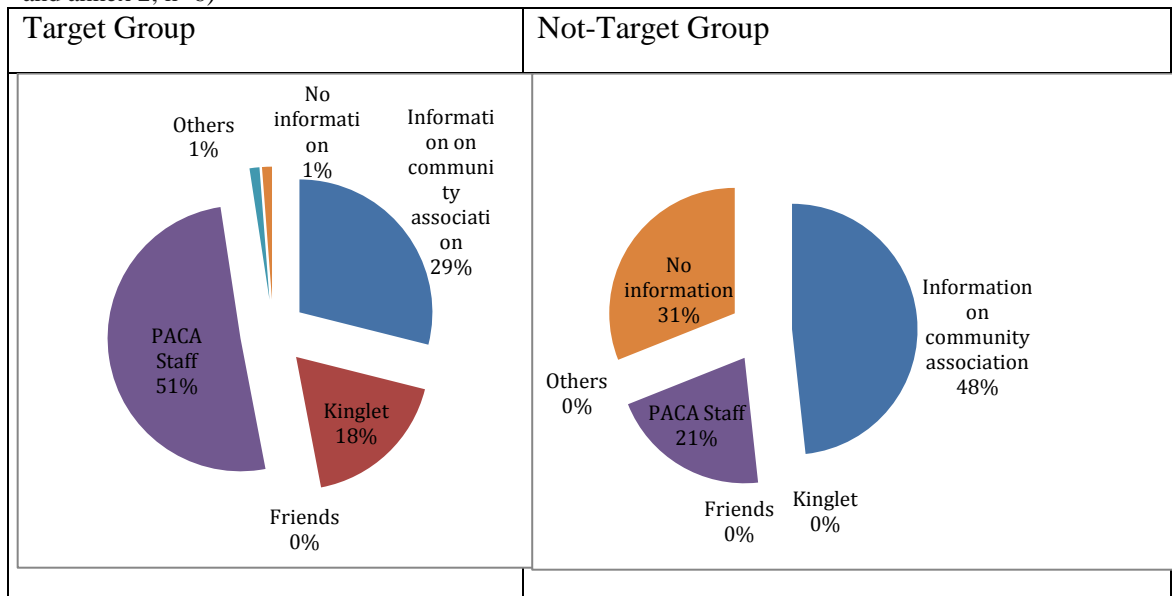


Source: Own elaboration

The very next question was to complement and comprehend the previous one. Was asked how the respondents (target and not-target group) knew about it. 43% answered PACA staff because before the project design, according to PACA (2016a), PACA staff

was in each community announcing their proposal and objectives in order to get people prepared for their project; 43% answered that they got the information on the community association. According to PACA (2016a) the project had preference on covering people who were part of associations due to the fact that they supposed to be more organized, more engaged with growing in their agriculture or livestock activity as well as by the fact that they already use to be part of a collective group that is, working with other people. In societies where had not associations or organized groups, the kinglet and other leaders were in charge of organizing collective action or groups. That's why 13% choose kinglet (is the most important and respected person in the community related to cultural issues) as a source of information. The reason why in one of the question addressed to the not target group was asked why they were not covered by the project the main answer was that is not part of the community association. Another crucial aspect here is the fact that the kinglet or the community leaders are the ones responsible for everything in the community so, every project that happens they are in the leadership. This for arguing that the community members to be chosen to be part of a group or privilege to engage in projects depend on them, community leaders. This can raise situations of “corruption” and privilege actions. According to TESE information, this kind of situations is complicated to turn around because is a community-based project and communities are the one who have the decision-making power. Decision power reflects on the leaders or the kinglet. Information that involves kinglet and leaders are not disclosed among community members (including respondents) because can raise several bad situations.

Figure 32: Illustration of PACA's acknowledgment by percentages (questionnaire responses-annex 1, n° 6 and annex 2, n° 6)

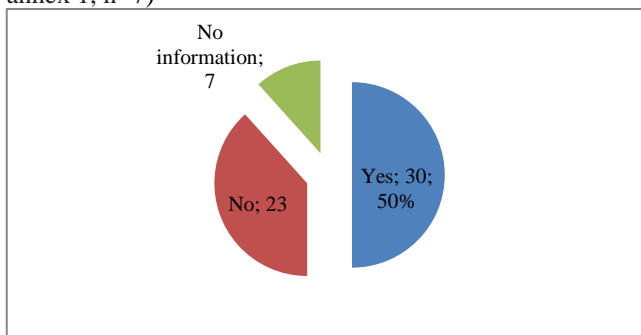


Source: Own elaboration

Until this point was made description comparing the target group and not target group as the questions were the same. By the end of the questionnaire description, we will get back to the last questions regarding them opinion about PACA. Following will be the descriptions to the target group questionnaire:

Besides all the questions that were described above, there was a questioned about who is part of the Management Committee (MC) to understand both sides, from the MC as managers and from the ordinary users. 50% were part of the MC! Occurs because was easier to interview them as are more interested in the project and because they are more aware of development issues and want to be heard.

Figure 33: Illustration of Management Committee members by percentages (questionnaire responses – annex 1, n° 7)

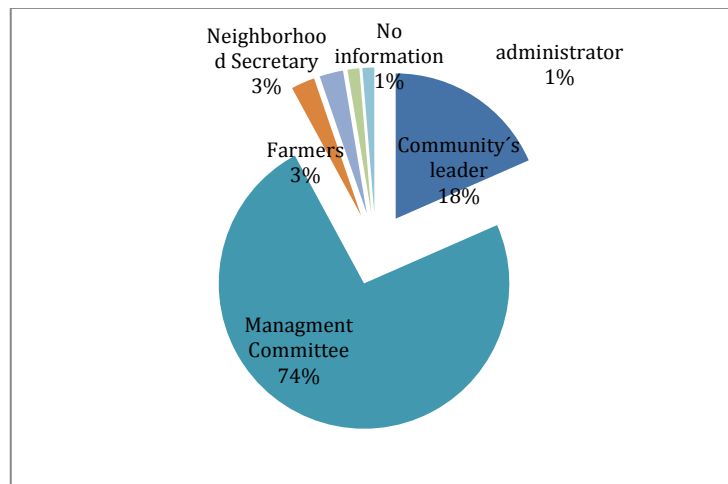


Source: Own elaboration



Respondents were asked about their awareness about who is in charge of maintaining the water infrastructure. The majority answered that is the MC and in second place the community leaders. This happens because the infrastructure organization and management is under the responsibility of the community (PACA, 2016a).

Figure 34: Illustration of responsibilities for the infrastructure maintenance by percentages (questionnaire responses – annex 1, n° 8)



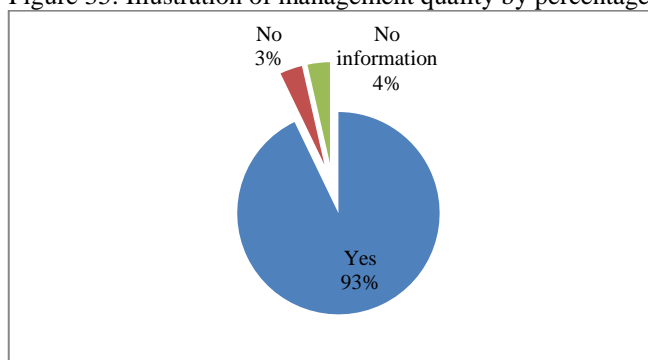
Source: Own elaboration

Was asked if they know who is in charge of keeping the money. 73% answered that is the treasurer, who is part of the Management Committee (MC); 14% said that is the MC and 13% is "no information." To be sure about the money that they pay for water, even though was written on the PACA reports, was asked how much they use to pay for using it. All of them answered 50 MZN and 100 MZN which match with PACA reports. This question was drawn to understand about a possible dishonesty that can eventually occur. Was also asked to them about their perception of the taxed amount (50 MZN): 75% answered that it's fair value, 9% think that is low, 2% that is high and 14% did not give any information about it. There were some suggestions about the monetary value to be applied: two people suggested 60 MZN, 1 suggested 30 MZN and 1 indicated 25 MZN. According to PACA information, this is a group decision.

Then was asked if they knew why the money was charged for, to assess their understanding and engagement with the project: 39% answered that is for the system maintenance; 39 replied that it is to pay the security responsibility for the system and 18% responded that is the reserve fund. All these answered match with the Paca reports information (PACA, 2016A & b).

To comprehend their satisfaction and good interaction with the MC was asked if the MC well manages the water infrastructure and if the MC was well and justly constituted. 86% answered that MC was well formed, 7% replied that "no" and other 7% is "no information." People that respond "no" argue that is because MC does not respect them; other argues that is because they work not so well. However, people that said "yes" claim that MC is important because they help in maintaining the system in good conditions, they are responsible people, and they can put people together. Furthermore, 93% responded that the installations are being well managed as illustrated in the graphic below.

Figure 35: Illustration of management quality by percentages (questionnaire responses – annex 1, n° 15)



Source: Own elaboration

As reported by PACA (2016a & b) in all target communities there is a brochure regulation for the using of the water infrastructure. Everyone that uses the infrastructure should know about it as well as the rules that this regulation defines. This regulation is under the community responsibility as well as the project . Every rule that is changed or added must be included in the brochure. This is the reason why respondents were asked if they knew about the brochure regulation. 89% answered that they know about it, 9% answered "no, " and 2% was "no information."

According to with PACA reports (2016a & b) was stated that training took place in all communities, training such as "Food processing and conservation," "Food and nutrition security," "Conservation agriculture," "Climate change" and "Management of community water infrastructure." The reason why was asked if the training helped them and most of the respondents answered that "yes" helped them, though, other respond "no" arguing that the time was concise to learn a lot of important subjects. The question

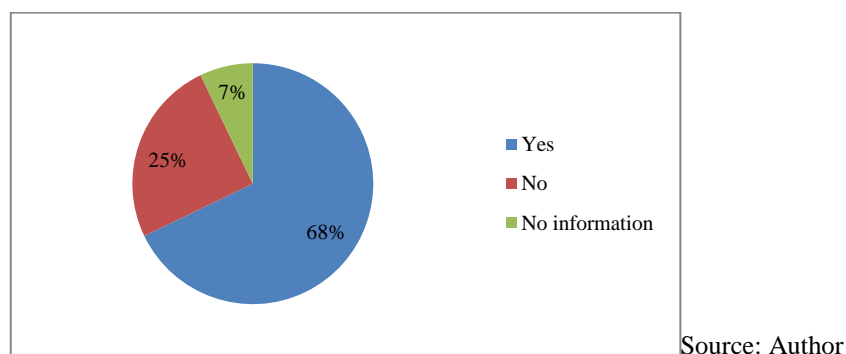
that followed was if they would like to have more training, where 21% answered that do not need, and 79% answered "yes." The respondents that said "yes" were asked which kind of training and most of them replied to in the agriculture area, others on climate change and others on the infrastructure management.

Another question that we wanted to find out was if someone from the PACA staff still goes the communities after the project has finished, understanding if there is some assistance by the PACA side. Therefore, 51% answered "yes", 31% answered "no", 2% said "not always" and 13% gave "no information. People that said "yes" argue that the support received is related to maintenance and repair of the installations.

Before going through the final questions of the questionnaire, the results of the non-target group will be presented.

The group was asked if they knew about PACA project. 68% of them answered that they knew about PACA, 25% did not know about it, and 7% gave no information.

Figure 36: Illustration of PACA´s acknowledgment by percentages, non-target group (questionnaire responses)



Also here most of them answered that knew about the project in the community association and others with PACA staff or the through the kinglet.

They were also asked if they are part of the group that benefits from the PACA project and 56% said that they benefit from the water that project provided and 43% said "no." According to TESE information, the ones that said "yes" is because they use water from the water fountain as everyone can since they pay for it. To get water from the water fountain provided by PACA is not need to be part of the target group. The ones that said "no," claimed two main reasons for not being part of the "target group." One is because they are not part of the association and other because they just were not invited. Even

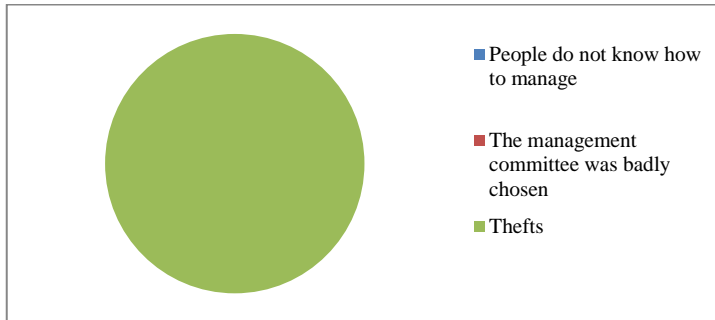
though, they are not part of the target group some of them was asked to give an opinion regarding the project design. When we asked them if somebody asked their views before the project was launched, 44% answered "yes, " and some said that was requested them an opinion on the community association and others that were the kinglet. Was followed asked them if they would like to be part of the target group. Where, 71% answered "yes" would like to be part of the target group, 4% answered "no," other 4% answered "maybe" and 21% gave "no information."

To have their opinion, as outsiders were asked if they think that infrastructures are being well managed. 53% said "yes," 43% said "no" and 4% "I do not know." Respondents that said "no" gave all the same answer, which was because of robberies, that is, robberies that happened in the communities. According to Kulima information, robberies occurred in two of the studied communities, Mafuiane and Michangulene. Just after the project has finished were robbed solar panels in these two communities. The solar panels were robbed by members of other communities that were not affected by PACA project. This information came up because the same thieves were caught in Kala-kala community when they were trying to steal the water pump. The thieves were taken to the police in Namaacha village. Kulima supported the communities on the purchased of some solar panels as well as hired an organization to set up the panels. It is important to highlight that Kulima afforded only part of the solar panels because some stolen panels were recovered. The solar panels in the two communities were robbed because their security system was weak, unlike Kala-kala that is the stronger reason why the thieves were caught there. After all, Mafuiane and Michangulene reinforced their security system. The curious was that the target group did not mention these robberies. Kulima information said that is because those groups are more cautious, they do not want to raise problems regarding the project management, they do not want to point fingers to each other, they rather being quiet when it's about problems. That is, problems that can call into question the integrity of some members.

When asked Kulima whether they will support the communities for a long term, was answered that they only supported de communities because the PACA project had just finished. Furthermore, because Kulima is the organization that is more in contact with the communities as they have been working with the communities since long-time and had to maintain their reputation among the communities. Kulima does not have the

responsibility to support the communities. Communities have to support themselves managing their infrastructure (Kulima information, 2017).

Figure 37: Illustration of why the system was not being well managed, by percentages (questionnaire responses – annex 2, n° 11)

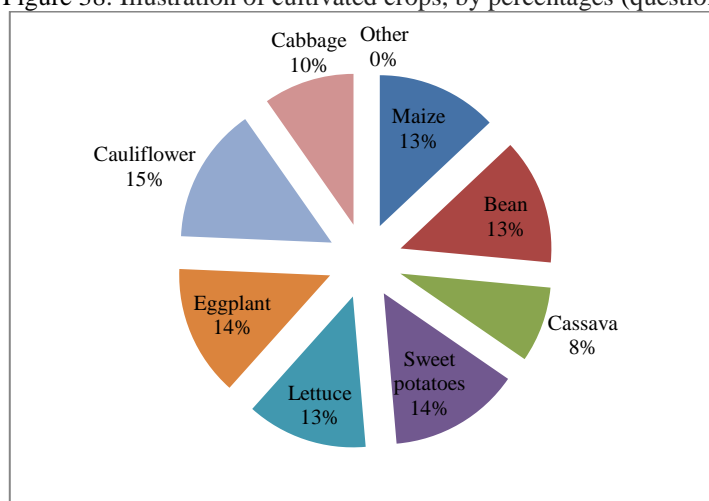


Source: Own elaboration

Was followed asked them whether they use the water provided by PACA even though they do not belong to the target group. The majority with 52% answered "yes," 45% said "no" and 3% said "sometimes." The majority said yes because according to TESE information, albeit people are not part of the target group they can use the water if they obey to the established rules and with the MC permission. The majority use the water for domestic's activities and the minority for agriculture activity. To understand if the target group and not target group are charged the same value for water was asked which monetary value they pay. Was confirmed that was the same amount that every user pays, 50 MZN and 100 MZN.

To know about other water sources were asked them if they do not use PACA's water, where do they get water. 50% said in the community's well, 46 % stated in the river, and 4% gave "no information." Was asked to this group which crops they produce. Where, was answered that they produce maize, bean, cassava, sweet potatoes, cauliflower, lettuce, cabbage, eggplant. That are almost the same crops/seeds that the PACA distributed to the target group, that is, that the community asked for.

Figure 38: Illustration of cultivated crops, by percentages (questionnaire responses – annex 2, n° 15)



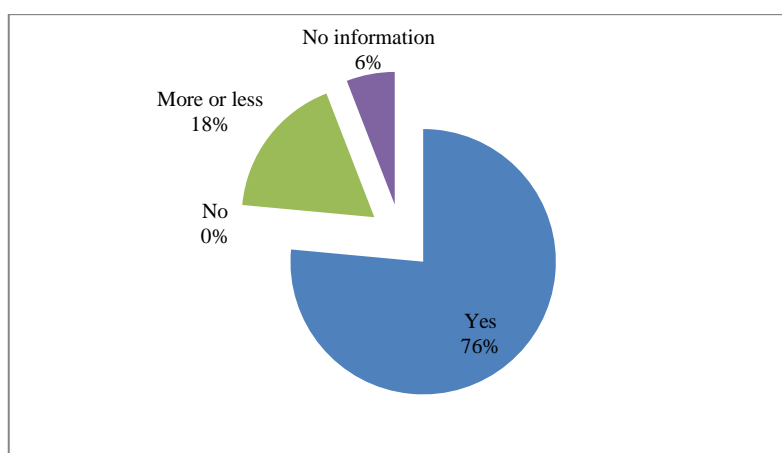
Source: Own elaboration

To understand why they do not produce another kind of crops was answered by 34% of the respondents that is because the land does not produce, 31% said that was because of lack of seeds and others 31% was "no information."

Will be presented below the description of the last questions of the questionnaires regarding the satisfaction and the impression of the both groups, particularly the target group, regarding the PACA project.

Was asked to the target group if they liked PACA project. The majority said "yes" with 76%, 18% said "more or less" and 6% was "no information."

Figure 39: Illustration of target group satisfaction regarding PACA project, by percentages (questionnaire responses – annex 1, n° 22)

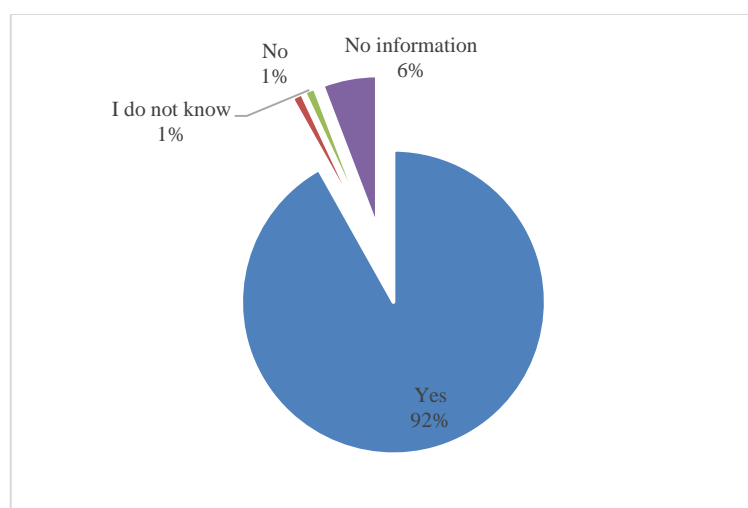


Source: Own elaboration

The similar question was made to the not target group, asking them if they think PACA was a good project (both, for who is using the water and for those who do not). Where, 65% answered "yes," 14% said "more or less," other 14% said "I do not know" and the 7% was "no information."

When was asked to the both groups if they think PACA will be a good project for others communities that were not covered this time, most of them answered "yes" with 92%; 1% said "no"; other 1% said "I do not know" and 6% was "no information". They all have the same opinion when asked to justify their answer, such as everybody should have the same benefits; to have equality; this kind of project is beneficial; to solve drought issues; to let them know about climate change; to help on the lack of water.

Figure 40: Illustration of target group opinion regarding PACA project in other communities, by percentages (questionnaire responses – annex 1, n° 23)



Source: Own elaboration

To conclude was asked to the both groups whether they have some recommendation to the PACA project.

The target group gave some opinion/recommendations as it's essential to provide support to the peasants or small farmers because they need these kinds of projects; they think that should be for everyone, that is, cover more people; it is important to help other farmers; they advise to PACA that next time they should be more organized; the project was welcomed, though, was very short duration; they ask for monitoring; they complain about the training duration; one said that the climate change training was weak, saying that should be more clarified and also argued about the time duration

altogether; others stated that the project was too short and was no time to present doubts; some claim that should have had more monitoring throughout the project; one said that short duration projects do not help; others want to thank PACA project for the support and are asking for more projects.

The not target group gave very similar answers among them. The main argument was about project time duration, which they said that small projects do not help anyone! Other opinion/recommendation gave by few of them, which belong to Kala-kala community, was about a dam that should be a better solution to that community as they have rivers nearby.

Strangely they do not argue a lot about not belonging to the target group or the type of selection to belong to that group.

After the above questionnaires description and discussion will be linked the results of the questionnaires and the results found on the documents to the Ostrom's "Design Principles."

#### **4.1 “Design Principles” in the communities**

Was found and verified that many of the "Design Principles" are ruled the Commons management, that in this case is the water infrastructure governance fomented and supported by PACA projected through a collective action. The collective action was constituted in all target communities as one of the key features of the project. As approached above in the questionnaire discussion PACA project prioritized people, who were part of associations. If there were no associations in the communities, was the community leader such as the kinglet or the neighbor secretary that was in charge to form a group of people. According to Kulima information, the kinglet is the most important and respected person in the community related to cultural issues, and the Neighborhood Secretary is the most important regarding laws and official issues. Highlighting that the Kinglet is the most important in these societies where the cultural aspect is the more respected. So everything that happened in the community must be first presented to the kinglet. PACA project even! Kulima information said that was very important that some of the constituents of the group should know how to write and



has a minimum of knowledge and "cleverness" so the group can go forward and sustain. Usually, these "clever" people are the ones who are leading the groups. To conclude, the constitution of the collective action/target groups were the community's responsibility. Following will be presented and described the "Design Principles" on the three communities in a broader context as well as individuals when needed. To make an analysis and evaluation using "Design Principles" framework, was pertinent for these study to use 7 out of 8 "Design Principles" by Ostrom. Considering that the eighth principle-"nested enterprises" is focused on big systems (Ostrom, 1999). Therefore, it's not related to the Commons governance system on the present study communities. This study is related to small/medium systems!

The first "Design Principle" (1) is defined limits. By the time that PACA project arrived on the communities and started to approach the communities the first thing done was organize the target group that was the people that they began to work with. Fortunately, in the three studied communities there was already communities associations, so was not need to form new groups. Usually, people in the associations already have the social capital built up, or it assumes that they have. Since the groups have been working together as an association. According to Kulima information, some limits dictate who is using the water and who is not. For instance, when is regarding the water fountain everyone in the community can use since they pay for the water. However, when it comes to the watering tanks or drinking fountains for livestock, only the farmers or cattle breeders that are part of the target group can use it. As the infrastructure preservation are their responsibility. Furthermore, among the target group, there is a Management Committee (MC) which are the group who is responsible for the infrastructure management as a whole, which for instance organize the system security or the money issues. It's known about the resource (water) boundaries that according to the water flow or existence (drought, floods or regular periods) they are supposed to know how to manage since this resource can be considered predictable. According to PACA report (2016a & b) was expected that was consumed per day 50 liters per person. So, there are defined limits for resource users, resource units, and infrastructure!

The second "Design Principle" (2) is the coherence! According to PACA reports (2016a & b) as well as other documents that prove the existence of regulation for the use of the community water supply system in each community. According to the Regulation

document of Michangulene (2016) for instance, "This regulation aims to define the rules for the use by the beneficiaries of the Community Water Supply System, which was built within the framework of the PACA Community Adaptation Community Action Plans in the community of Michangulene in the district of Namaacha." (pp. 4). Furthermore, its state in this document that "...All beneficiaries of the catchment and water supply system after this referred to as the system, should have access to this regulation and be acutely aware of the rules laid down. What is written in this regulation must be strictly adhered to." (pp. 4). Was confirmed in the questionnaires outcomes, most of the group members know the existence of it. The goal of this Regulation's document as stated in, pp. 4, is "this regulation is applicable to the activities of use, protection, and conservation of the System Infrastructures in Michangulene and aims to define the rules for a correct use of the system and to hold those who use it unduly or damage them."

The Regulation document was structured by the PACA project, although, the communities themselves established the content. As community members are responsible for the infrastructure and they know better the context of the community where they live. In these documents include aspects as who are the beneficiaries; what the utilization rates are; what care to take with elements of the system; what are the responsibilities of the management committee; which operating hours; and which interdiction and use fines. So, each community has its Regulation established by their context, that is, there is a level of coherence between the CPRs and the local conditions. Rules makers are the third "Design Principle" (3)! Here it's important to be sure that the rules established can be changed by the users. As written above, the content of the Regulation's document was set by the target group of each community. According to the Regulation documents "The content of this Regulation may be amended when the Management Committee so wishes. These changes should be inserted in this document and communicated to the community." (Mafuiane Regulation document 2016, pp.4). According to TESE information, the MC is who established the rules, and if some of the members eventually want to change or add some rules, the MC has to be asked and discuss it for future decision.

Controlling, which is referring to monitoring, is the fourth "Design Principle" (4)! As stated in the Regulation document "The District Planning and Infrastructure Services

(SDPI), the Local Authorities and the Infrastructure Management Committee shall be responsible for controlling what is defined in this regulation." (Kala-kala Regulation document 2016, pp.4). Besides this external monitoring or controlling, the Management Committee it's also responsible for ensuring the good practices and the supervision of the infrastructure as well as de resource behaviours among within the group (Mafiaune Regulation document, 2016).

The fifth "Design Principle" (5) it's related to the *punishment*! In keeping with the Regulation Documents, there are sanctions to the resource users that break the rule. In the Regulation Document of each community, the point that argues about this aspect is the point number seven "Fines and interdiction of use." In this stage, it is stated the reasons why resource users will be sanctioned as well as how much they have to pay for each infringement. As other points of the Regulation documents, each community has established their own rules. For instance, there is a rule at this stage that there is not in the other studied communities, "Those responsible for children under 15 (fifteen) years of age who are caught getting water from the fountain or washing tanks will be fined" (Mafuiane Regulation document 2016, pp. 8).

*Conflict resolution* it's the sixth "Design Principle" (6)! This point is related to the mechanism used to solve a conflict that can make possible rises among the group, and lower-cost mechanisms better are (Ostrom, 1999). According to Kulima information, it is common to arise conflict among the group. Conflicts such as betrayal and disagreements are the ones mentioned by Kulima information. When conflict arises, they try to solve among the group. In cases where it is impossible to solve among the group, it's summoned the Kinglet to address cultural issues. However, if the conflict is related to legal problems, that is litigious problems, problems that the Kinglet is not able to solve, are summoned the public entities specifically the Neighbor Secretary. For instance, when the robberies happened, the Neighbor Secretary was called, and when the thieves were caught, they were taken to the police station.

The last "Design Principle" that is following be analyzed is the seventh (7), rights to self-organize. According to Ostrom (1999), this point discusses the rights that the groups have to organize themselves and make their own rules without external or governmental intervention. As mentioned at the beginning of the thesis, specifically on the Project description, PACA project was designed by MITADER that is a ministry

hence, a Governmental Entity. Therefore, the Government allowed them to self-organize as implemented this project with such characteristics.

Following will be presented a table, summarizing the "Design Principles" existences in each community.

Table 6: Summarizing “Design Principles” in the communities: Kala-kala, Michanguele, and Mafuian

Design Principles	DP characteristics	Community	Existence...or not	Description
1. Defined Limits	Limites that defines who can use the infrastructure and the quantity of water that resources users can use (50l per day each person can use)	Kala-kala	Exists	Ntuanano Group (irrigation tank) and Population of Mabenga (tap near the water catchment hole)
		Michangulene	Exists	Kanimambo Farmers Association (irrigation tank) and Breeders of Michangulene (drinking fountain)
		Mafuiane	Exists	Group of Farmers of Zone "D" (tank of irrigation) Population of Zone D (water fountain) and Population of Zone D (tanks for washing)
2. Coherence	Coherence between enforced rules and local context	Kala-kala	Exists	There is regulation for each community according to each context (Kala-kala Regulation document 2016)
		Michangulene	Exists	There is regulation for each community according to each context (Michangulene Regulation document 2016)
		Mafuiane	Exists	There is regulation for each community according to each context (Mafuiane Regulation document 2016)
3. Rules makers	who can make and change the rules	Kala-kala	Exists	Management Committee of Kala-Kala is responsible make, change and enforced the rules
		Michangulene	Exists	Management Committee of Michangulene is responsible make, change and enforced the rules
		Mafuiane	Exists	Management Committee of Mafuiane is responsible make, change and enforced the rules
4. Controlling	monitoring process	Kala-kala	Exists	Controlling is made by the District Planning and Infrastructure Services (SDPI), the Local Authorities and the Infrastructure Management Committee
		Michangulene	Exists	Controlling is made by the District Planning and Infrastructure Services (SDPI), the Local Authorities and the Infrastructure Management Committee
		Mafuiane	Exists	Controlling is made by the District Planning and Infrastructure Services (SDPI), the Local Authorities and the Infrastructure Management Committee
5. Punishment	sanctions that resource users pay for transgressing rules	Kala-kala	Exists	Each fine has a value of 200 meticals and Whoever is fined more than 5 times is forbidden to withdraw water for 1 year.
		Michangulene	Exists	Each fine is worth 120 (one hundred and twenty) meticals, and Those who are fined more than four (4) times are prohibited from taking water for one (1) year.
		Mafuiane	Exists	Each fine has a value of 200 meticals and Whoever is fined more than 5 times is forbidden to withdraw water for 1 year.
6. Conflit resolution	Conflit resolution methods	Kala-kala	Exists	Depending on the level can be solved by the resource users, Kinglet or public entities
		Michangulene	Exists	Depending on the level can be solved by the resource users, Kinglet or public entities
		Mafuiane	Exists	Depending on the level can be solved by the resource users, Kinglet or public entities
7. Rights to self-organize	whether the community have rights to self-organize	Kala-kala	Exists	Allowed by MITADER (Ministry of Land, Environment, and Rural Development)
		Michangulene	Exists	Allowed by MITADER (Ministry of Land, Environment, and Rural Development)
		Mafuiane	Exists	Allowed by MITADER (Ministry of Land, Environment, and Rural Development)

Source: Author

## **4.2 Project objectives**

PACA project mission was to “Contribute to increasing Mozambique's resilience to the impacts of climate change with the implementation of concrete adaptation measures identified through participatory community processes” (PACA 2016a, p. 6).

In each community according to the community needs through participatory approach have its objectives. That is, according to PACA reports (2016a and 2016b) most of the nine communities have the same general goals and similar specific objectives (depending on the problems that were presented to be solved in each community, but in general are all related to water issues), that is:

- General objective - contribute to increasing the resilience of community to climate change impacts, including through increased availability of livelihoods and better food and nutrition security, breaking the cycle of poverty and reducing the incidence of climate change.
- Specific objective - Increase capacities and access to water and the means for diversification and sustainability of sources of income associated with subsistence agriculture and livestock activities.

Following will be presented a table with the objectives in each community as well as their achievement:

Table 7: Project objectives in the studied communities

Community	Objectives	Objectives description	Status	Observations
Kala-kala	General Objective	Increase in family income (MZN / Month) in the district	No information	No data available
	General Objective	Reduce the number of cases of waterborne diseases	No information	No data available
	General Objective	Reduce the number of animals lost due to extreme events (diseases, floods, droughts)	No information	No data available
	Especific Objective	Increase of 20 to 30 household Kala-Kala using water from the community water supply system for irrigation of the machambas	Achieved	29 household using the water
				No data available, to be assessed after crop harvesting
	Especific Objective	Increase of 20 to 30 Kala-Kala household using dryer	No information	
	Especific Objective	Number of farmers involved in agriculture adapted to climate change	Achieved	29 farmers involved
Michangulene	General Objective	Increase in family income (MZN / Month) in the district	No information	No data available
	General Objective	Reduce the number of cases of waterborne diseases	No information	No data available
	General Objective	Reduce the number of animals lost due to extreme events (diseases, floods, droughts)	No information	No data available
	Especific Objective	Increase of 20 Michangulene farmers using water from the community water supply system for irrigation of the machambas	Partially Achieved	18 farmers using the water
				No data available, to be assessed after crop harvesting
	Especific Objective	Increase of 20 Michangulene farmers using dryer	No information	
	Especific Objective	Number of farmers involved in agriculture adapted to climate change	Achieved	18 farmers involved
Mafuiane	General Objective	Increase in family income (MZN / Month) in the district	No information	No data available
	General Objective	Reduce the number of cases of waterborne diseases	No information	No data available
	General Objective	Reduce the number of animals lost due to extreme events (diseases, floods, droughts)	No information	No data available
	Especific Objective	Increase of 20 to 30 Mafuiane households using water from the community water supply system for irrigation of the machambas	Achieved	25 household using the water
				No data available, to be assessed after crop harvesting
	Especific Objective	Increase of 20 to 30 Mafuiane household using dryer	No information	
	Especific Objective	Number of farmers involved in agriculture adapted to climate change	Achieved	25 farmers involved

Source: Adapted from PACA, 2016b

As can be seen in the table above, all the general objectives have no information about the achievement of it. Was not only the general objectives of the three studied communities, according to PACA reports (2016a and 2016b) there is no information regarding the general objectives achievement in all nine communities. According to PACA reports and TESE's information, the general objectives are the ones that can only be ascertained in the medium or long term. For instance, the general objective related to the number of the reduced diseases caused by water issues, there was no data available to understand if it was reduced or not. The project had finished in December 2016,

when the time of the compilation of the reports by PACA they had not data to analyze it. Even by the time of the questionnaire made for this studied there was no information about it because people were still getting used to the water system and the adaptation measures implemented. According to TESE information, it is expected that the general objectives would be achieved successfully.

The specific objectives were easier because were the objectives specific to each community, this is, the problems that the PACA project was supposed to solve. So the specific objectives could be analyzed within a short term, that is, right after the finishing of the implementation of the adaptation measures. For instance, the specific objective related to the number of farmers involved in agriculture adapted to climate change was easy to determine if this objective was achieved or not right after the finishing of the project. However, there is an objective related to the number of farmers using the dryer that is also a medium/long term analysis because was needed to wait until the crop harvesting to get the data for this purpose.

#### **4.3 Overall Project evaluation**

In a general appreciation the PACA project was according to the Community-Based Adaptation project characteristics, though, with some exceptions:

First of all was crucial to present collective actions features which were verified through the groups that benefited from PACA project. Was checked through the questionnaires that the groups present the minimum level of social capital (trust, reciprocity, and cooperation) characteristics.

The projects include climate change long term predictions and the resulting adaptation solutions according to (TESE) information. The water problems solved with the implementation of infrastructures in the communities were to face droughts and floods issues. The dryer given by the PACA project to the target communities was also to help people to face times of scarcity by conservation the food.

The project did not include climate change long term predictions and the resulting adaptation solutions according to TESE information. This occurred because the project was supposed to solve problems that affected the communities in that precise moment and the strategies were drawn according to with the group's priority needs. However,



the water problems solved with the implementation of infrastructures in some communities were to face droughts and floods issues. The dryer given by the PACA project to the target communities was also to help people to face times of scarcity by conservating the food. Furthermore, there are some beliefs related to the climate change or "changes in the weather" that difficult those peoples understanding. Was through the questionnaires that were found out that most of the people believe that "climate change" occurs because of GOD others belief that happens because of obscurantists reasons. The project does not design a "risk management". The project was conceived for solve problems related to the drought. However, according to TESE information, there is an organization (INGC - National Institute of Disaster Management) that is working with risk management in the Namaacha region.

Was praised local responsibility and autonomy on the strategies process because the strategies implemented by the PACA were drawn through the participatory process, that is, was the community who stated the problems and the possible solutions. However, according to (TESE) information, some solutions declared by the community members were not very good and sustainable; therefore, the project designers advise them on the best strategy. For instance the building of some water infrastructure namely water well, the community member suggested building nearby the river. However, PACA stuff proposed building in some safer place taking into account the possible rise of the river levels.

Since finding out the solutions for the implementation of the drawn strategies the PACA project was using participatory approach, that is, always in touch with the community. According to the PACA (2016a and 2016b) were always reinforced the communities first needs. However, was found out on the questionnaires that some strategies implemented were not their needs and some reported that their needs were not fulfilled. According to TESE information, it is very complicated to fulfill everybody's needs, and it is very reasonable that in this places people complain about their needs.

The last characteristic to be analysed regarding the CBA projects is that it must reduce poverty and increase livelihoods – According to PACA reports (2016a & b) alleviate poverty and improve livelihoods was the part of the mission of the project. As argued above is hard to determine whether this mission was fulfilled or not, because this kind of evaluation has to be done in a medium/long term.

However was interviewed a person that rather be mentioned as anonymous, is the opinion that the project had many problems. The anonymous argue that the project had some problems and that in his opinion's hard to affirm this project as sustainable. The first problem that this person claimed is about the seeds that were distributed for PACA project. He said that the seeds were distributed and cultivated in a regular procedure. However, after harvest people did not cultivate again arguing that there were no more seeds. Therefore, the field was abandoned, and no more seeds were cultivated. Even on cases, where PACA was giving support to build up areas of cultivation (*machambas*), those fields were abandoned. People were claiming about lack of seeds. When was asked to this person about one of the objectives that were "increase in family income" in each study community, he said that there is no increasing because people are not yielding. The yield was only by the time that people had the seeds, after that, they did nothing more. According to this person, people were supposed to produce and sell the outcome, therefore, buy more seeds by them. Hence, PACA sustainability could be sure. The reason why these people do not act this way can be because of pure negligence. This negligence is usual in these regions and these people. The problem here was the lack of time! The project was concise, and people needed time to understand how to do things work. Was necessary a long term monitoring! Monitoring was another problem raised by this person! There was no long term monitoring! According to him, MITADER argued that was no money to do such activity. Although KULIMA information said that there is a "follow-up" of the activities. Follow-up that is made by the District government people, that sometimes go to the communities check if everything it is ok. When the anonymous person argues about monitoring, he was not referring to a simple "follow-up." He was referring to monitor people's activity regularly, giving support to them until they can manage themselves successfully. This anonymous person finishes his interview by highlighting the time spent for this project, in his opinion was very short and impossible to achieve the primary objectives successfully. He also referred to the lack of schooling and sense of understanding by the people that he associated with the negligence. That was also concluded that "time" could work in this aspect also. If there was more time to explain them about things, this issue could be overcome.

#### **4.4 Lessons learned identified from the project**

According to PACA report (2016b, p.64), the lessons learned in the field that is important to be signed and eventually shared are:

1. "The interventions carried out in the communities could count on the active participation of the population, from the diagnosis, through the proposal of solutions, to the implementation of the activities. This involvement allowed:"
  - a) "To design simple solutions to adapt communities to climate change based on their real problems and needs; these were of small scale and easy maintenance, being able to respond to different identified problems."
  - b) "Identify the key aspects of the success of training sessions as they will depend on changing inappropriate behaviors and capacity building that will effectively increase their community resilience to the impacts of climate change."
  - c) "Adjusting components or modifying the details of the intervention, better responding to the needs of the community and achieving greater efficiency in the application of the means."
2. "All the conversations and meetings are moments of target group awareness, in which opportunities are created to convey concepts related to the sustainable management of the natural resources on which their livelihood activities depend. However, the deeper changes in behavior are difficult to ensure during the short duration of the PACA, and it is advisable to promote the continuity of actions, to consolidate the contents of the training sessions."
3. "The intervention carried out in the village of Namaacha allowed to reach a greater number of beneficiaries, possible due to the visibility created by the PACA in public buildings of the Village. This intervention can thus be seen as an example by much more people than interventions in communities, and it also hopes that proximity to decision makers will strengthen the creation of more and better strategies to collectively increase resilience to the impacts of climate change."

4. "The time frame for implementing the PACA, with particular emphasis on Namaacha interventions, was a premise that, to some extent, had some impact on results. The appropriation and consolidation of knowledge are built over time, variables that are difficult to ensure in the short duration of the PACA."

## Conclusion

Mozambique can be taken as a country that is engaged in environmental issues and that have included this matters on the country's development agenda. As an **example** of it is the adoption of the NAPA-National Adaptation Action Plan, as well as being developing projects through this platform. These projects are seeking to reach the most vulnerable people, the rural communities. Although they are to be praised, most of the times these projects have some failures that are important to be analyzed for correcting in future projects. As an example is the PACA project that is the case study of this master thesis.

The results from the documents analyses as well as the questionnaires outcomes and literature review have helped to answer the research question.

As answer to the research question, it may be said that in what concerns the overall evaluation of the project as well as from the water infrastructure management., it may be asserted that PACA project has Community-based adaptation projects key features, according to the literature review.

Although some characteristics have some particular aspects that were not met, such as climate change's long term prediction, PACA argues that it was not their objective, and that there is an external government organization that is supposed to provide this information to the community. Climate change awareness was not fully achieved because PACA argues that's hard for making rural people understand about it, because of their beliefs. This aspect adds to the lack of schooling. There was no "risk management" strategy because PACA claims that there is also another organization in charge for this issue. There was no monitoring, because of a supposed lack of money; instead there was a "follow-up" of the activities done by the District government.

Related to the issue of the Commons governance, it may be concluded that the water infrastructure management was ruled according to the "Design Principles" by Ostrom. The regulation of the community's infrastructure system was ruled for 7 out of 8 "Design Principles." The eighth was not included because is related to complex systems. According to Ostrom (1999), the more "Design Principles" are presented in a particular system, the more increases the probability of that system to be successful. The "Design Principles" were examined through PACA documents analyses, literature

review, and answers to questionnaires to the target communities. Until the moment of this study, the system was working reasonably, though with some problems such as theft of some materials that support the system; lack of knowledge about system management as a whole; as well as some problems in the social capital such as trust issues among the community.

Concerning the objectives of the project, if they were met or not, PACA's documents were used, and questionnaires and interviews were analyzed. The conclusion was that the specific objectives were met as they were about the implementation of the solutions, and the achievement was in the shot time. About some objectives, such as general objectives and some specific objectives that need long term analyses, there was no information about their achievement. The lack of data that is raised for the fact that the project has finished recently makes it difficult to ascertain long term results. One of the primary objectives of the PACA project was to enhance resilience, though, is difficult to find out and verify long-term resilience short time after the end of the project. Besides, the research's fieldwork was done in a short-term. According to Cox et al. (2010,p. 40 cfr. Baggio 2016) that defines "success" as cases that "reported successful long-term environmental management". That is why it is almost impossible to conclude at the present moment if these study cases are successful self-governed systems or not.

A last answer ,about the sharing of the lessons learned on the PACA project, that can be taken as an example to future CBA projects, was stated in the chapter before.

The design and the conception of the PACA project are “wonderful” and "perfect." The project was designed with sustainable aspects to be praised. Simple processes were used during the term of the project: simple processes of collecting data, of involving the community in the project, simple ways of teaching them, as well as installations constituted with simple infrastructures. Renewable energy namely, solar panels were used. As a way of capturing water, they invested in groundwater.

However, we think that PACA project was designed as an illusion of achieving results that from the beginning was known as "impossible" to achieve: It is not possible to be successful in a year of project implementation in 9 communities throughout the country. The average time in each community since implementation until training sessions plus one month of monitoring was only about 3 to 6 months. This time is not enough for many aspects, for instance, one of the primaries crucial, the learning. Having the

awareness that the project is addressed to people with less schooling or even without schooling should be taken in utmost. As Ostrom and other scholars argue, it's critical to study the target context before designing the project (Ostrom, 1999). This argument is not for diminishing people with less schooling because even people with education need time to learn. The human being, in general, needs time to digest things. Therefore individuals or entities such as government, NGOs or funders, cannot ignore or pretend that these small, but big, aspects are not crucial to a success of any society. The opinion about the short-term of PACA project can be found on the PACA reports; it was also obtained through the questionnaires made to the target communities, where local communities claimed a lot of the short time as well as on the interviews made to the stakeholders.

As Ostrom (1999) states, some projects, development projects objectively, are merely a political opportunity and strategy. All that matters are statistic numbers. Numbers for the organizations such as the project designers, the funders, and all the stakeholders involved. Statistic numbers that make those organizations bigger and recognized by the national or international community. That is the reason why the statement from Deleuze (2004, p. 20, (cfr. Saunders, 2014) makes sense: "It is not enough to say the institution is useful, one must still ask the question: useful for whom?"

Based on the result of the study it is recommended that Project designers should be more realistic about the projects that they design, taking into account several factors. Factors such as the context of the community, that is their particular characteristics: The money made available for the project that must be calculated and accounted for so that all phases of the project are included, at least the most important ones such as long term monitoring after the end of the project; and the time enduring of the project should have to be revised in future projects. It would be better to be successful in few communities, being sure that the project is getting a long term enduring, instead of wanting to cover nine communities with not so well ensured success.

Recommendations are also made for the funders, that it's also their responsibility to ensure the project endurance and sustainability before funding such projects.

PACA is one of the many projects that will be developed in the country regarding climate change adaptation. These projects and this kind of effective self-governance on

small-scale irrigation could be an example for other communities along the country and abroad.

Future studies are recommended, over time, regarding the successfulness of the PACA project. As well as further researchers can try to understand more about the monitoring and evaluation problems on climate change and development projects in Mozambique.



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## Annex 1

### Questionário (Grupo Alvo)

Comunidade \_\_\_\_\_ Idade \_\_\_\_ Sexo: F \_\_\_\_ M \_\_\_\_

Ocupação \_\_\_\_\_ Numero de Filhos \_\_\_\_

Sabe ler/escrever: Sim \_\_\_\_ Não \_\_\_\_

1. Sabe o que são mudanças climáticas? a) Sim \_\_\_\_ b) Não \_\_\_\_
2. Se respondeu sim na resposta anterior, escolha o que define mudanças climáticas:  
a) Alterações na temperatura \_\_\_\_ b) Seca \_\_\_\_ c) Chuva \_\_\_\_  
d) Doenças \_\_\_\_ e) Aquecimento global \_\_\_\_ f) Outros \_\_\_\_ Qual  
\_\_\_\_\_  
\_\_\_\_\_
3. Caso tenha respondido a questão 2, diga qual a sua crença em relação as mudanças climáticas:  
a) Deus \_\_\_\_ b) Acontece naturalmente \_\_\_\_ c) Tradição (curandeirismo, feitiçaria) \_\_\_\_ d) Não entende porque \_\_\_\_ e) Outro \_\_\_\_  
b) Qual  
\_\_\_\_\_  
\_\_\_\_\_
4. Qual destas organizações já ouviu falar ou conhece?  
a) MITADER (Ministério da Terra, Ambiente e Desenvolvimento Rural)  
\_\_\_\_\_  
b) CAOS-Borboletas e Sustentabilidade \_\_\_\_ c) Kulima \_\_\_\_  
d) Tese-Associação para o Desenvolvimento (TESE\_SF) \_\_\_\_ e) Nenhuma \_\_\_\_
5. Já ouviu falar de Programa de Adaptação as Alterações climáticas (**Projeto PACA-** Planos de Ação Comunitários de Adaptação) /o projeto de água que aconteceu em 2016? a) Sim \_\_\_\_ b) Não \_\_\_\_
6. Faz parte da Comissão de Gestão das instalações que o projeto implementou aqui na comunidade? a) Sim \_\_\_\_ b) Não \_\_\_\_
7. Quem é responsável por manter o projeto aqui na comunidade? Qual das pessoas mencionadas abaixo:

- a) Chefe da comunidade \_\_\_\_ b) Regulo \_\_\_\_ c) Grupo de mulheres \_\_\_\_  
 d) Grupo de Juventude \_\_\_\_ e) Comité de Gestão \_\_\_\_ f) Agricultores \_\_\_\_  
 g) Secretário do bairro \_\_\_\_ h) Chefe do Posto \_\_\_\_ i) Administrador \_\_\_\_  
 j) Outro \_\_\_\_.

Diga qual \_\_\_\_\_

8. Preencha com “X” o quadro abaixo, assinale todos que achar bem:

Medidas de adaptação	Problemas que a comunidade tinha antes do projeto	Problemas que a comunidade pediu que o projeto resolvesse	Problemas que o projecto resolveu
Poço			
Tanque de rega			
Bebedouro			
Furo de captação de água			
Torneira no furo de água			
Fontanário			
Tanque lavandaria			
Sistemas de aproveitamento água das chuvas			
Distribuição de sementes			
Material agroprocessamento/ Secador			
Outros			

9. Como é que é feito o pagamento da água que o projeto instalou?

a) Não paga porque é inteira responsabilidade do Governo \_\_\_\_

b) Dinheiro \_\_\_\_ c) Troca de serviços ou outro \_\_\_\_.

Qual? \_\_\_\_\_

10. Quem é o responsável por receber o dinheiro?

a) Tesoureiro \_\_\_\_ b) Comité de Gestão \_\_\_\_ c) Outro \_\_\_\_.

Quem \_\_\_\_\_

11. Qual o valor cobrado?

a) 50 MZN \_\_\_\_ b) 100MZN \_\_\_\_ c) Nenhum \_\_\_\_ d) Outro \_\_\_\_.

Qual? \_\_\_\_\_

12. Considera o valor:

a) Elevado \_\_\_\_ b) Justo \_\_\_\_ c) Baixo \_\_\_\_ d) Não sei \_\_\_\_ . Sugira um valor

\_\_\_\_\_

**13.** A que se destina o dinheiro cobrado?

a) Manutenção do sistema \_\_\_\_ b) Pagamento ao segurança do sistema \_\_\_\_

c) Pagamento de quem gere (Tesoureiro, Comité de Gestão, Outros) \_\_\_\_

d) Fundo de reserva \_\_\_\_ e) Ao Projeto PACA \_\_\_\_ f) Ao Governo \_\_\_\_

g) Outros \_\_\_\_ . Quem? \_\_\_\_\_

**14.** Na sua opinião, acha que foi BEM escolhida a comissão de gestão?

a) Sim \_\_\_\_

b) Não \_\_\_\_ . Porque? \_\_\_\_\_

**15.** Acha que as sistemas de adaptação instalados para água estão a ser bem geridos pela comissão de gestão?

a) Sim \_\_\_\_

b) Não \_\_\_\_ . Porque? \_\_\_\_\_

**16.** Tem conhecimento da existência de regulamentos para o uso e bom funcionamento das instalações? a) Sim \_\_\_\_ b) Não \_\_\_\_

**17.** De acordo com informações do Projeto PACA, houve formações e palestras sobre mudanças climáticas e agricultura. Pensa que estas formações ajudaram lhe no seu dia-a-dia e a esclarecer duvidas que tinha? a) Sim \_\_\_\_ b) Não \_\_\_\_

**18.** Precisa de mais formações?

a) Não \_\_\_\_

b) Sim \_\_\_\_ . Em que área? \_\_\_\_\_

**19.** Ainda aparece na comunidade alguém do PACA depois do projeto ter acabado?

a) Sim \_\_\_\_ b) Não \_\_\_\_

**20.** Recebe alguma ajuda do Projeto PACA?

a) Não \_\_\_\_

b) Sim \_\_\_\_ . Se sim, escolha uma das opções:

a) Financiamento/Dinheiro \_\_\_\_ b) Manutenção/Reparação das instalações \_\_\_\_

c) Outro \_\_\_\_ . Qual \_\_\_\_\_

**21.** Gostou do Projeto PACA?

a) Sim \_\_\_\_ b) Não \_\_\_\_ c) Mais ou menos \_\_\_\_

**22.** Acha que era bom que houvesse Projeto PACA em outras comunidades?

a) Sim \_\_\_\_ b) Não \_\_\_\_ . Porque? \_\_\_\_\_

**23.** Tem algum comentário ou recomendação a fazer em relação ao projeto?

a) Não \_\_\_\_ b) Sim \_\_\_\_ . Qual? \_\_\_\_\_

## Annex 2

### Questionário (Não Grupo Alvo)

Comunidade \_\_\_\_\_ Idade \_\_\_\_\_ Sexo: F \_\_\_\_\_ M \_\_\_\_\_  
Ocupação \_\_\_\_\_ Numero de Filhos \_\_\_\_\_  
Sabe ler/escrever: Sim \_\_\_\_\_ Não \_\_\_\_\_

1. Sabe o que são mudanças climáticas? a) Sim \_\_\_\_\_ b) Não \_\_\_\_\_

2. Caso tenha respondido a questão 1, diga qual a sua crença em relação as mudanças climáticas:

a) Alterações na temperatura \_\_\_\_\_ b) Seca \_\_\_\_\_ c) Chuva \_\_\_\_\_  
d) Doenças \_\_\_\_\_ e) Aquecimento global \_\_\_\_\_ f) Outros \_\_\_\_\_.

Qual \_\_\_\_\_

3. Qual a sua crença em relação as mudanças climáticas:

a) Deus \_\_\_\_\_ b) Acontece naturalmente \_\_\_\_\_  
c) Tradição (curandeirismo, feitiçaria) \_\_\_\_\_ d) Não entende porque \_\_\_\_\_  
e) Outro \_\_\_\_\_. Qual \_\_\_\_\_

4. Qual destas organizações já ouviu falar ou conhece?

a) MITADER (Ministério da Terra, Ambiente e Desenvolvimento Rural) \_\_\_\_\_  
b) CAOS-Borboletas e Sustentabilidade \_\_\_\_\_ c) Kulima \_\_\_\_\_  
d) Tese-Associação para o Desenvolvimento (TESE\_SF) \_\_\_\_\_ e) Nenhuma \_\_\_\_\_

5. Já ouviu falar de Programa de Adaptação as Alterações climáticas (Projeto PACA-Planos de Ação Comunitários de Adaptação) /o projeto de água que aconteceu em 2016 na sua comunidade? a) Sim \_\_\_\_\_ b) Não \_\_\_\_\_

6. Se respondeu sim a questão 5, diga como é que soube do projeto?

a) Informação na associação da comunidade \_\_\_\_\_ b) Régulo \_\_\_\_\_ c) Amigos \_\_\_\_\_  
d) Pessoal do Projeto PACA \_\_\_\_\_ e) Outro \_\_\_\_\_.

Qual? \_\_\_\_\_

7. Faz parte do grupo de pessoas que beneficiou do projeto?

a) Sim \_\_\_\_\_  
b) Não \_\_\_\_\_. Porque? b.1) Não precisa \_\_\_\_\_ b.2) Não foi convidado \_\_\_\_\_ b.3) Não tem dinheiro \_\_\_\_\_ b.4) Não faz parte da associação \_\_\_\_\_ b.5) Outro \_\_\_\_\_.

Qual? \_\_\_\_\_

**8.** Se respondeu não na questão anterior, responda se gostaria de fazer parte do projeto?

a) Sim \_\_\_\_ b) Não sei \_\_\_\_ c) Talvez \_\_\_\_ d) Não \_\_\_\_.

Porque? d.1) Não precisa \_\_\_\_ d.2) Não gosta de projetos \_\_\_\_

d.3) Não faz parte da associação \_\_\_\_ d.4) Não confia \_\_\_\_ d.5) Outro \_\_\_\_.

Qual? \_\_\_\_\_

**9.** Foi convidado para entrar no Projeto PACA?

a) Sim \_\_\_\_ b) Não \_\_\_\_

**10.** Alguém pediu a sua opinião quando o projeto começou?

a) Não \_\_\_\_ b) Sim \_\_\_\_.

Quem? b.1) Pessoas do projeto PACA \_\_\_\_ b.2) Régulo \_\_\_\_

b.3) Associação da comunidade \_\_\_\_ b.4) Outro \_\_\_\_.

Quem? \_\_\_\_\_

**11.** Acha que as instalações ou a água do projeto esta a ser bem gerida?

a) Sim \_\_\_\_ b) Não sei \_\_\_\_ c) Talvez \_\_\_\_

d) Não \_\_\_\_.

Porque? d.1) As pessoas não sabem gerir \_\_\_\_ d.2) Foi mal escolhida a comissão de gestão \_\_\_\_ d.3) Roubos \_\_\_\_ d.4) Outros \_\_\_\_.

Qual? \_\_\_\_\_

**12.** Mesmo que não tenha beneficiado do projeto todo, utiliza a água que o projeto instalou?

a) Não \_\_\_\_ b) As vezes \_\_\_\_ c) Sim \_\_\_\_ .

Para que? c.1) Para machamba \_\_\_\_ c.2) Para uso de casa \_\_\_\_ c.3) Outros \_\_\_\_.

Qual? \_\_\_\_\_

\_\_\_\_\_

**13.** Se respondeu sim na questão anterior, diga se lhe cobram pela água que usa?

a) Não \_\_\_\_ b) Sim \_\_\_\_ . Quanto? b.1) 50 MZN \_\_\_\_ b.2) 100 MZN \_\_\_\_ b.3) Outro \_\_\_\_ . Quanto? \_\_\_\_

**14.** Se por acaso não use a água do projeto, assinale de onde consegue água?

a) Rio \_\_\_\_ b) Poço da comunidade \_\_\_\_ c) Água das chuvas \_\_\_\_

d) Outro \_\_\_\_ . Qual? \_\_\_\_

**15.** Assinale o que produz:

- a) Milho \_\_\_\_ b) Feijão \_\_\_\_ c) Mandioca \_\_\_\_ d) Batata-doce \_\_\_\_ e) Alface \_\_\_\_  
f) Beringela \_\_\_\_ g) Couve \_\_\_\_ h) Repolho \_\_\_\_ j) Outro \_\_\_\_.

Diga qual \_\_\_\_\_

**16.** Porque não produz outras culturas?

- a) A terra não produz \_\_\_\_ b) Falta de água \_\_\_\_ c) Falta de sementes \_\_\_\_  
d) Não precisa \_\_\_\_ e) Não sabe plantar \_\_\_\_  
f) Outros \_\_\_\_.

Qual? \_\_\_\_\_

**17.** Acha que o PACA é um bom projeto?

- a) Sim \_\_\_\_ b) Não \_\_\_\_ c) Mais ou menos \_\_\_\_

**18.** Acha que era bom que houvesse Projeto PACA em outras comunidades?

- a) Sim \_\_\_\_ b) Não \_\_\_\_ . Porque? \_\_\_\_\_

Tem algum comentário ou recomendação a fazer em relação ao projeto?

- a) Não \_\_\_\_ b) Sim \_\_\_\_ . Qual? \_\_\_\_\_



## Annex 3

### 1. Map of Mozambique within the African Map



Source: Worldatlas (2017)

### 2. Map of Mozambique illustrating main rivers and provinces



Source: Worldatlas (2017)



